

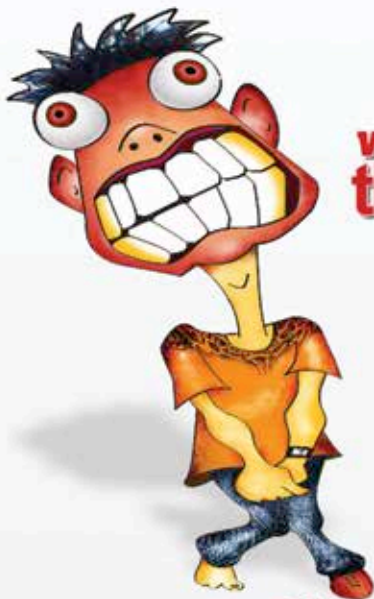
digit **FastTrack**

YOUR HANDY GUIDE TO EVERYDAY TECHNOLOGY

TO **Chrome OS**

- Introduction to Cloud computing operating systems
- Chrome OS: The biggest thing from Google
- Chrome OS vs. Traditional OS vs. Chromium OS
- Are you a Chrome person?
- Best of both worlds – Dual booting with Chromium
- Salvaging a Chromebook and making your own personal cloud
- Must have apps for a Chrometastic experience
- Tips and tricks
- Future of Chrome OS and Cloud computing





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CHROME OS

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COVER DESIGN: SHIGIL NARAYANAN

Introduction to FastTrack for Chrome OS

Traditional operating systems, be it Windows, Mac or Linux-based, have held us tied down to a few out-dated assumptions for computers. We've embraced them as a given and continued to adopt upgrade after upgrade without much thought. But now we've reached a point where Google, unlike legacy OS creators Microsoft and Apple, is changing the way we perceive operating systems. Now is the dawn of the cloud based operating system and Chrome OS is its most prominent emissary.

But despite Chrome OS's growing popularity across a variety of industries, it is misunderstood. Isn't Chrome OS just a browser masquerading as an operating system? Is it all hype? How can you really use it? Well, these questions are just the start of this month's issue of FastTrack.

We take a couple of chapters to quickly distinguish Chrome OS's identity and show why Google is so deeply invested in it as a product. We delve deeper into the subtleties of the cloud based systems that Chrome OS is so notorious about and explain what an "appliance computer" is meant to be. We move on from these technical and industry discussions to help you determine if Chrome OS is a viable alternative for your work and lifestyle.

We next move on to the real fun stuff with a chapter that gives a detailed review of Google's Chromebooks which are currently available in the market. We cover all the essential details of Google's product line from price to performance, and even point the way to the expected releases coming up in the near future.

The next few chapters systematically guide you towards experiencing your very own Chrome OS system. These surprisingly easy steps allow you to test drive and take on the operating system using its open source cousin

– Chromium OS. And for the adventurous few, we even discuss the repurposing of obsolete computing machines into efficient cloud computers. We also add a chapter filled with a handy set of tips and tricks which will make your Chrome OS experience easy and enjoyable. And finally wrap it up with our little insights as to what we think the future of cloud computing holds, and how it will affect you.

This issue of FastTrack is your friendly guide to crossing the emerging paradigm threshold of the computing world. We look forward to hearing from you so let us know your thoughts and views at: editor@thinkdigit.com. 



INTRODUCTION TO CLOUD COMPUTING OPERATING SYSTEMS

Everything you wanted to know about
Cloud Oses because everybody else was
too dumb to tell you

What is Cloud Computing?

Back in the day, the average organization would be required to purchase a whole bunch of computers, associated softwares. With time the software would go out of date because of which the head of IT would be left with two problems in his hands. The first being that he now needs to update the software on every single computer (while remembering to factor in the fact that new employees will be joining the organization) and the second being the fact that chances are, the old computers might not have the necessary specs to run the new softwares, meaning another upgrade.

With cloud computing, the problem is solved. In theory at least. In cloud computing, the software and the hardware required to run it are on somebody else's server. All you will be required to do is run install an application that serves as the interface to the service. The server does all the processing and saves your data, while your computer only needs enough resources to run and display the interface which could be done with just a web browser.

As I type this article on Google Drive, a server that probably half way across the world is computing every keystroke and displaying them on my screen. My computer doesn't need to worry about running a heavy word processor and doesn't turn the heat up to eleven and try to cook my thighs. The point is, with cloud computing, your computer doesn't have to pull the weights and work overtime. Somebody else's computer does that for you.

This brings us to the next question- Why was there a sudden burst of cloud base applications and where has it been all this while?

Well, it's been around for quite a while. In fact most popular e-mail services are cloud based as your mails are all stored off shore and the whole sending and receiving has been carried out by a server. The earliest reference to cloud computing was in the 50's where computers, used in academics and by corporations would be accessible via terminals which would only serve as a connection to the computer and would compute anything on their own. As a sort of return on investment, these computers were accessed via these terminals, thus laying down the foundations for cloud based computing. With better internet speeds and stability, the idea of cloud OSes is in the process of taking off.

How does an OS work on cloud?

The first thing you need to know about Chrome OS is that it's a cloud based operating system. What are they you ask? While the operating systems on most computers works off the computer's hard drive, a Cloud OS or a



Plug in or else...

Web OS on the other hand runs off a remote server. What actually runs on the computer is merely an interface which could even be something as basic as a web browser. All your data is saved on a remote server too. Your computer will require a smaller hard disk and less RAM and still run everything from word processors to spreadsheets, to games, to photo editors, to instant messaging and a whole lot more.

Since all a cloud OS needs is just something to serve as an interface, quite a few work clean out of a browser, giving new meaning to working on the go. Just find any old computer anywhere in the world with an internet connection and log in. Everything you were working on will be right where you left it- even if you choose to access it using your smartphone.

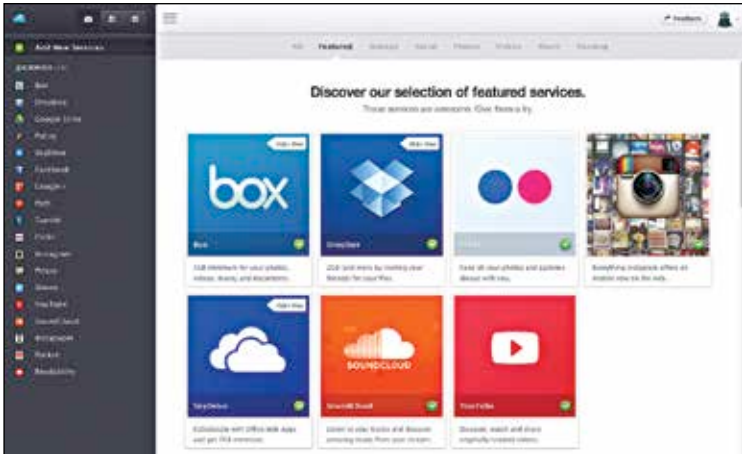
With cloud OSes, even ancient computers can become relevant again. The only catch when it comes to cloud OSes is the fact that you will constantly be connected to the internet. Which will be a problem in both the current scenario as well as the near future as with more users coming on board, the demand for faster, stabler connections will rise. The same will also enable heavier programmes developed for normal OSes to run off the cloud. Seeing that the speeds available to the rest of the world is yet to catch up South Korea's, it's definitely in the horizon. Only problem is that nobody can accurately tell where that lies.

What are the available choices?

Since this entire Fasttrack is on the Chrome OS, the first one on the list is the Chrome OS, but because we have an entire issue to talk about it, let's look at what else is available.

Jolicloud

Currently in its second iteration- Jolicloud 2, Jolicloud is developed by a French company of the same name which was started in 2009. While Joli-



Jolicloud- Two million 'not too bads' and counting...

Jolicloud is a browser based OS, users can also download and install their Joli OS on their computers, replacing their existing OS and access Joli's cloud based service - Jolidrive.

A Jolicloud account (you can also log in via Facebook and Google) gives users access to Jolidrive where users can integrate all their cloud storage accounts ranging from Dropbox to Google Drive in to the side bar. Users can even decide what kind of files go where and reorganise them by dragging and dropping them from one place to another. It also has a very good system that integrates your social media accounts displaying them in a feed based format.

With over 15,000 available apps, it's supposed to work best on Chrome over other browsers and according to them, over two million users agree that Jolicloud isn't too bad.

iSpaces

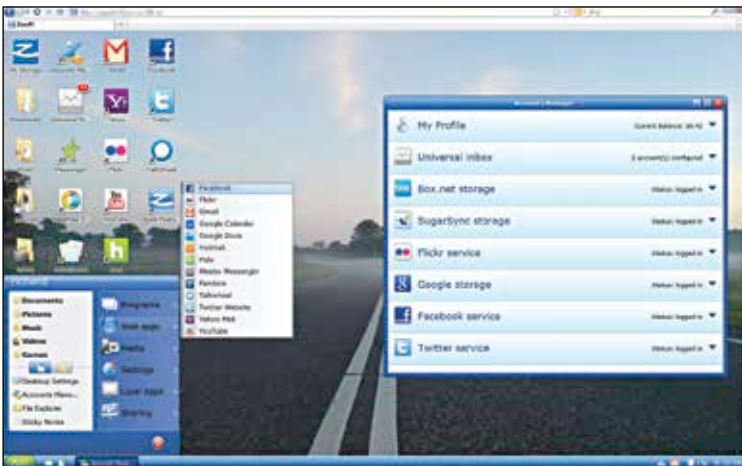
People on the go, will really appreciate iSpaces' 'NonStopWeb' persistence technology. What it does is that even if you log out of one computer and log in from another, it keeps everything you were working literally the same way you had left it. It works on open tabs, documents and cloud storage drives. The second thing you'd appreciate is the fact that they give you a whole Terabyte of space on signing up. The third thing you will definitely appreciate will be the fact that you can integrate your other cloud storage

accounts seamlessly and even move things from one account to another by just dragging and dropping.

It presents the users with three desktops which can be organised based on whether you are at work, at home or for lack of a better example, a third place. All things aside (including creepy women telling you why you should use iSpaces [just google it.]), it's a pretty nifty cloud OS.

ZeroPC

If you have a whole bunch of photos scattered across an even larger number of cloud storage platforms and have no idea how to bring them together, then ZeroPC will solve that problem. ZeroPC is yet another cloud based OS and this one's developed by Zero Desktop Inc. in California. It looks and feels very much like the kind of OSes people have gotten used to so far and like the other two, you can very easily move files from one cloud storage platform to another and there's an inbuilt media player too. Interestingly,



Look at all the shortcuts!

ZeroPC has an app that can be downloaded on to your smartphone or Tablet and runs on iOS, Android, Amazon's version of Android. It even has an extension for the Chrome web browser.

While Jolli,iSpaces and ZeroPC are all cloud based OSes which can be accessed through a web browser on just about any computer, it brings us to another question:

Is Chrome OS really a Cloud OS and how is it different?

For starters, Chrome OS comes pre installed only on Google's Chromebooks. They take about seven seconds to boot and you're ready to go. While Chrome, like any other Cloud OS requires a functioning internet connection to get any work done, the little space you have in its tiny SSD can be used to run Gmail, Docs and the media player in offline mode. You can also pick and choose a whole bunch of apps designed specifically for Chrome. Once you're back online, the applications sync and normality is restored.

But the fact that you can't exactly work on Chrome from the comforts of a random computer deep in the jungles of South America, sort or negates the one main distinction between a cloud based OS and a traditional OS.

But the fact that most of the apps that work offline are only a bunch of games and productivity tools, one wouldn't be wrong in calling Chrome OS a cloud OS. So what if it's available



Is this the future?

only on Chromebooks? It's merely following Google's tradition of an exclusive introduction before it goes commercial. Remember when Gmail was by invite only?

Secondly, Chromebooks are currently your only means of accessing Chrome OS could be because the hardware is designed keeping in check the basic specs needed to run it properly. While it may seem like a limit at the moment, in the near future, it could mean that Google might have spent the time in between perfecting a version of Chrome OS that does work on any old computer.

At the end of the day, you will have to agree that the fact that a few basic applications do run without the need for an internet connection gives you the best of both worlds. The fact that the device running it is streamlined to give you maximum performance sweetens it and finally, the fact that since you entire computer is the Chrome browser, using other cloud OSes is a cinch is the cherry on top. 



CHROME OS: THE BIGGEST THING FROM GOOGLE?

We walk you through the history and
design of the Chrome OS phenomenon to
unravel this mystery

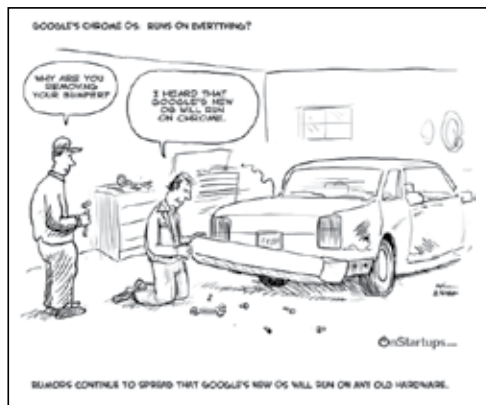
It took Google only a few years to become a household name. From web searches to email, their synonymity with the online world grew exponentially with numerous innovations and acquisitions. And even as the world holds its breath in anticipation for the famed Google Glass product, the engineers over at the Googleplex are more giddy than ever about Chrome OS. Why is that?

Isn't Chrome OS just a browser interface that only works when you're connected to the internet? Isn't it just useful to connect all your Google services under one umbrella? Sure, it makes your Google experience better but do we really need to consider it an "operating system" and pay for a lightweight Chromebook that can't even game? Well, the answer to all those is yes. But there's so much more.

So, what is it?

Chrome OS is an open source operating system designed by Google as a lightweight web based client. The operating system is ideal for netbooks, tablet PCs and out-dated hardware systems that have become obsolete. It's key utilities are based on the internet and rely on an active web interface to accomplish its major tasks. All data is intended to be stored in cloud servers and applications can be either web based or run locally on machines.

The most unique feature of the Chrome OS is its much touted seven second boot up time which is possible due to its streamlined design, that reworks the traditional system architecture of an operating system and hardware relationship. The operating system is designed to be run on Intel x86 and ARM processor chips. At its purest state Chrome OS has only one locally run application which is the browser and is integral to the operating system interface. Both the browser and OS are set up to be auto-upgraded from Google's servers in a seamless manner adding new updates and features.



The integrity of Google's version of the Chrome OS is advertised with all these features but is predicated on the specific hardware configurations made by partner manufacturer's such as Samsung, Acer, Lenovo and HP. The open source version of Chrome OS that is available online is known as Chromium and isn't supported by Google, rather it is developed, updated and released by the open source Chromium developer community. It's hardware independent but isn't able to offer all the speed and update features as Google's Chrome OS.

But beyond it's simple addition to the marketplace, where Windows, Mac and numerous open source operating systems are competing, Google Chrome OS isn't intended to be considered like any other operating system. Chrome OS is a web based appliance computing device - what does that mean exactly? Read on.

Chrome OS: Origins

Before we can truly explain the depths to which Chrome OS is more than just a browser interface or a Google experience enhancement, we have to consider its humble origins. The Chrome OS project was initially a quiet affair within the halls of Google as far back as 2006 when Jeffrey Nelson



Chrome OS look during it's early beta stages.

came up with the idea. The idea took off and ended up getting him a patent #8239662 titled “Network Based Operating System Across Devices” in 2012.

But the journey from idea to patent was not an easy one since the very idea of a cloud based operating system was hard to define in 2006, even for Google executives. The management team at Google didn’t quite grasp the idea and it was rejected outright. Given the fact that it was originally written using the Mozilla Firefox internet browser application, there was an in-built resistance to the idea itself. The original design of the Chrome OS was based on a stripped down version of Linux known as PuppyLinux which had numerous restrictions which made it a tedious build.

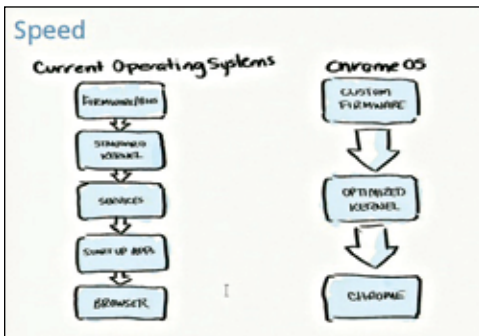
By the end of 2007, Nelson had augmented the design of his operating system to move away from the PuppyLinux and Mozilla Firefox backbone system and migrated it to the Chrome browser system with the help of the Google Chrome team. The Chrome browser hadn’t yet been commercialised yet but was in development at Google. It would only be made publicly available in 2008. But behind it all the driving force of the Chrome OS was neither its web-app based functionality nor its lightweight Google backed networking features - Chrome OS was designed by a software developer to be a super fast operating system for developers like him.

The way to make a superfast operating system was simple - remove the entire desktop operating system from the hard disk on to the RAM memory. This would simplify the file input/output bottlenecks present in almost all operating systems and free up huge performance resources for a faster interface. Since most of the operations performed on any system are File I/O intensive and aren’t critically dependent on CPU speed, this shift to RAM based operations would execute tasks almost instantly without increasing any efforts towards the optimisation of the many other applications that make up the operating system. This shift radically improved speed and performance where application restarts such as web browsers went from a 45 second time delay to a 1 second time delay and code compiling became faster by 60 percent. This wouldn’t be possible on any hard disk. Even SSDs would only come close.

This form of system restructuring could only be possible if the risk of data loss could be eliminated - after all RAM memory isn’t meant for storing and recovery data. That’s where the cloud component came in since all of Chrome OS applications and data are stored in web-apps online, the risk of data loss could be mitigated by using secure and efficient web applications. The system essentially ran on the RAM and accessed data as it was

needed over the network making work not only faster but also safe. The shift to web-apps also improved system resource allocation as most web applications are designed to be agile and sleek in resource consumption making them less resource intensive on local memory.

As these innovations took shape over the course of the years between 2006 and 2009 the interest within the developer community mounted and eventually a non-proprietary version known as Chromium OS was released to the public. This release went on to form the Chromium OS Pro-



ject which encouraged independent research and development from the open source community. This open source connection allowed developers to add their own features for enhanced functionality and allowed the building of customised Chromium operating

systems. The largest difference between the two remained that while Chrome OS was supported by Google, it would seamlessly upgrade itself in the background while Chromium OS would have to be manually upgraded using developer released builds. Even the Chrome OS hardware restrictions have for the most part been sidestepped by the ingenious developer community that makes Chromium OS possible. The two versions remain close cousins.

But in the course of its development within Google, Chrome OS became more than just a developer's operating system – it became the operating system of anyone who lived their life on the internet. Google has gone on to corner the market on essential web applications in the enterprise and home departments with their Google Docs app as well as the use of the Google Play store to create a thriving market for web based applications that can be run via any browser – especially Google's Chrome browser. This parallel evolution of the web applications allows Google a direct utility link between it's ambitions for the Chrome OS, Chromebook device and the Google Play store web app market. The perfect ecosystem for anyone who is always connected. And that's just the beginning.

Chrome OS today

Since the initial design by Jeff Nelson which leveraged the RAM-centric operations of the PuppyLinux operating system, Chrome OS has gone a different way. The research and development of the project was ported to the Chrome browser and linked up to the cloud web applications ecosystem that Google was already offering. But even as these developments were arising in late 2010, there remained numerous other, better, alternatives to the same design.

Netbooks with their focus on low-cost, basic computing architecture could already support the Chrome browser and take advantage of the web applications systems. In order to truly distinguish itself from the image of a browser system to an operating system, Chrome OS rehailed its entire user interface and user experience. The current versions of Chrome OS have rolled-back from the initial design to provide users with familiar aspects of a traditional operating system such as a taskbar and the ability to locally store data.

In order to retain its key utilities of speed and security, the Chrome OS is best designed by Google within its Chromebook devices. The emphasis on Solid State Drives or SSDs compensates for non-RAM centric operations and retains the super-fast speed that would be its primary offering. The customised hardware configuration of Chromebooks is integral to the value of Chrome OS's security features as it not only streamlines the boot-up process on any machine but also verifies each step of the booting process to assure system recovery. Since the initial boot code is stored exclusively in



Multitasking? No problem. The Chrome OS can do all that and more.

read-only memory it can cross-check to detect system errors or infections. On top of all these features Chrome OS is observed to consume about one-sixtieth drive space as Windows 7.

The new Chrome OS also comes with a familiar file manager interface that is integrated in to the operating systems utilities for locating and running stored files. Media files such as MP3s, JPGs, videos and others can be played as well from local storage. In essence Google's Chrome OS system is allowing web-centric users access to a low cost machine that allows them to access most needed softwares in web-app avatars and allowing secure cloud storage of their data.

Due to these features, the Chrome OS is finding massive response in various enterprise and government sectors. In May 2014, Google and Intel announced a partnership which would allow Google to enhance it's promotion of Chrome OS across not only Chromebooks but other machines as well including Chromestations and Chrombases like the upcoming LG Chromebase which is intended to be an all in one workstation set up.

With the partnership with Inter the movement of Chrome OS is shifting towards as an alternative, not direct competition, to traditional operating systems. The lack of its ability to run resource heavy local applications such as professional video editing applications limits its reach. But many within the digital business community feel this may actually allow Google to capture a yet unquantified market in the PC market - the emerging section of consumer who use computers as an appliance.

Appliance Model of Computing

So what does it mean when we speak of Chrome OS as being an appliance operating system? In order to understand this difference we have to consider the fundamental features of the Chrome OS concept. As we've discussed, the four key aspects of Chrome OS are speed, security, stability and simplicity. All of these aspects of the operating system and the corresponding user experience have been the guiding principles behind the research and development of the Chrome OS architecture, specially with respect to its hardwired firmware design within the Chromebook devices.

The simple origins of the Chrome OS as a web browser based operating system may have changed with the inclusion of offline features, but its principle utilities are still web dependent. As the proliferation of mobile internet, wireless hotspots, workplace connectivity and personal networking has taken place, we find that the majority of computer usage is shifting



The coverflow like interface is nice to look at from a visual perspective

towards the web. In order to maximise this space the emergence of newer, faster and more secure web applications have already made their presence felt with major offerings from major software suppliers including Adobe and Microsoft.

However most of these applications continue to be resource heavy and rely on locally stored memory and localised processing power in the form of installed programs. But the trend towards web hosted applications is also on the rise such that we can already conduct most office suite related programs on the cloud using web applications such as Google Docs and with the increased usage of HTML5 we even find powerful image editing web applications like MugTug to be very useful.

Along with these developments, the need for mobile based online development is already underway with HTML/Javascript advances that seeks to make more complex programs functional via web browsers. In fact, Google has already announced that it is working towards building a Chrome browser based Native Client that would be capable of executing C and C++ based programs in a secure manner by binding them to the HTML5 interfaces. This shift would soon allow developers to leverage their skills to produce highly portable, high performance web based applications. All these developments simply implies that very soon, developers at all levels will not be required to produce installation based softwares, rather they would be able to release web accessible applications.

In this world, which is already seeing evidence of success on a small scale, the computer as a consumer device would no longer be bound by

its hardware restrictions such as local RAM or hard disk size when using applications that once were required to be installed – since they can now be accessed via web applications. Within this space, the Chrome OS is a perfect fit as it is designed to not install or execute locally stored programs. This is all the more evident for pleasure users like gamers who rely on heavy localised resources such as memory, storage and graphic accelerators, since the last five years have allowed popular games such as Unreal Tournament to be played via browser. With industry driven investment, browsers will play host to more than just MMORPG games of simple design but transcend into high end graphic oriented gaming that is powered solely by the web applications.

In this sense, the Chrome OS converts a computer into an appliance – a device that is a package of pre-configured applications running on a secured firmware based operating system. In an appliance model of computing,



Web apps (including games) play just fine on the Chrome OS

similar to the iOS style mobile systems, the configuration options are controlled which makes it extremely easy to use. The cross-industry utility of appliance based computers allow for the inclusion of customised on-board management tools which can be inte-

grated to an enterprise environment across a business corporation. Not only does this enhance the productivity of a virtualised work environment but also allow for easy cross-platform integration. In simple terms, an appliance simply works.

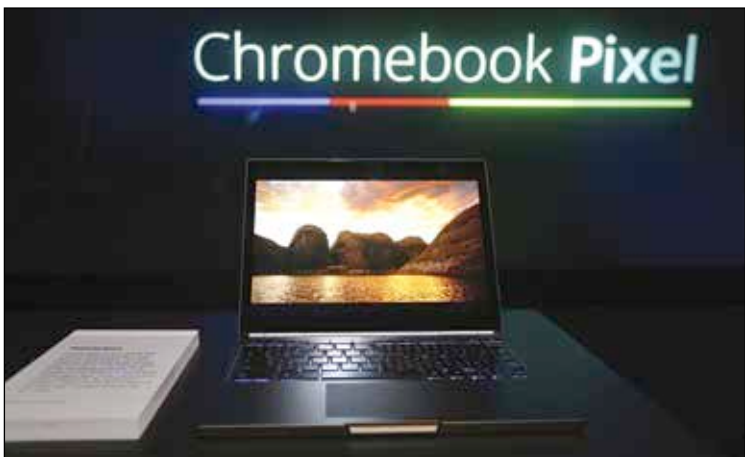
Imagine it like a high-end television or gaming console, the dedicated purpose of the technology is hardwired into the firmware and operating system of the device and ensures that it performs its core functions with speed, stability and security. In the same way, Chrome OS is intended to change the way consumers approach their online experience by removing the “computer as a device” model and shifting it to the “computer as a appliance” model. With Chrome OS this becomes a reality since the hardware costs are extremely low, the portability across hardware is seamless due

to cloud storage and the browser based web application usage is its key target. As long as the consumer's majority of operations can be fulfilled via browser based web applications the key selling point of the Chrome OS system is enhanced over time.

The appliance concept has already been accepted and integrated by consumers in their use of mobile phones where app services such as instant messaging, social media, email, entertainment, enterprise tools and others have already found great success. The addition of the Chromebook and Chrome OS simply seeks to leverage that user friendly attitude towards web dependent services and make it super fast, secure and stable for everyday use in a familiar computer oriented environment. In fact, the use of Chrome OS on mobile devices such as tablets and phones could potentially create a seamless digital ecosystem within which any user could do the majority of their work and play.

Google and the New User Experience

As Google partners with Intel market analysts already expect more than 6 million units of Chromebooks to be sourced in the next quarter. Along with this, the release of ChromeBase, ChromeStations and other Chrome OS based systems in governmental, educational and enterprise markets is slowly increasing quarter over quarter. The additional services from Google such as its Gmail tool, Adwords, Google Docs along with the ever varied



The Chromebook Pixel, which runs on Chromebook Pixel, sports a 2560x1700 pixel screen

Google Play store make the choice of Chrome OS far more cost effective for large organisations.

Google's direct threat to Windows' various products such as Office Suite, Cloud Storage and Enterprise Services is opening up the market for Chrome OS as a feasible alternative for users who don't wish to pay exorbitant licensing costs and software purchases, but wish to rely on secure and stable applications services.

And as Chrome OS evolves to make its user interface more familiar to traditional operating systems by allows local storage, external storage, local media abilities and file manager system, it becomes a more feasible



Chromebooks are cheaper than Windows based laptops

choice for users who spend most of their time online but wish to have the option of executing local media, if not applications. It is a certainty that Chrome OS will never be a direct competitor to Windows as it simply does not allow for local software installation.

This will ensure that users who wish to work on resource intensive programs will always prefer Windows or Mac based systems.

But for the majority of everyday users along with customised enterprise users, the Chrome OS environment will far payout in benefits what it lacks in other functionality. With a zero maintenance cost, higher security, superfast speeds, ease of use, foolproof design, elegant user interface and cost effective hardware, the popularity of Chrome OS can not be discounted just yet. And as more developers take mid-ranged applications to the web and game developers enable browser based HTML5/Javascript supported gaming, its a near inevitable truth that Chrome OS systems will become the computing appliances of tomorrow. 



CHROME OS VS. OTHERS VS. CHROMIUM OS

Google's Chromebook, the Chrome OS and the open source Chromium OS are similar but not the same. Understanding the differences amongst them along with how they differ from traditional operating systems is a must.

Chrome OS has been known to confuse and confound a variety of people - from naysayers who believe it's the biggest mistake made by Google to evangelists who can't seem to get over its functionality. In reality, the Chrome OS is a hybrid product that works more like an appliance like a smartphone rather than a traditional computer.

In its purest form within a Chromebook, it benefits from customised hardware/firmware that makes it perform at a much better level when compared to other netbooks/laptops of similar design. But it comes with its own baggage of restrictions that make users of traditional operating systems scratch their heads wondering if its a computer at all. The one thing that needs to be cleared up outright is that Chrome OS isn't an internet browser machine made exclusively for the internet. In fact, its something more subtle and fascinating.

Understand: Chrome OS vs. Traditional OS

Since the inception of graphical user interface operating systems like Microsoft's Windows or Apple's Mac OS X we as users have developed an expectation of what an operating system does. In our common experiences, operating systems are the platform on which we undertake all our computer based activities and as the decades have gone by it has remained one of the firm foundations of the user experience.

Traditional operating systems are intended to be our primary interface between our tasks and our hardware capabilities. They organise, collate and mediate the vast array of media, tools, applications and data that we need to work and play. The Chrome OS however seems to do away with many of these fundamental features such as the need to install applications on to the machine's hard disk. But this disruption of our expectations isn't all that Chrome OS is about.

A traditional operating system is built around the need for a variety of hardware components to symbiotically work as per our instructions



– from the manual control of computer subsystems like BIOS settings to something as simple as printing out a document - all of them are navigated through this legacy architecture. Chrome OS on the other hand does away with a lot of the manual set ups required like system drivers, hardware installation and on-board storage in exchange for a newer user experience.

The traditional style was centred on the permanency of our data and the method in which we worked with it - using softwares which needed to be installed on our systems and negotiated by our operating systems. This dealing between the numerous softwares we used would divide our computers resources leading to common problem like system lag, instability, crashes and security threats. The intent of the Chrome OS is to simplify this structure by using the internet itself as the platform on which all work takes place. The operating system then remains a simple, thing, web-centric client that securely connects you to all your data and applications.

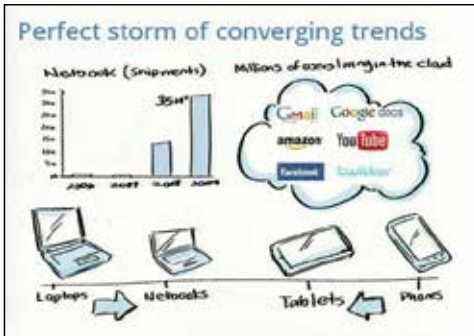
The important clarification needed here is that as opposed to softwares which we installed on our computers earlier, we would now use web based applications that are hosted on non-local servers along with our data. This demarcation is an essential tool of the web as the browser we use to surf is constantly accessing data on other servers with no local storage. A key example to understanding this is when you compose an email in your Gmail account the data is being worked on in Google's servers and not locally on your computer, however if you were to use an email client software like Thunderbird, the data would be composed locally and stored before being sent out over the net.

The direct access actions of the Chrome OS system over the internet is what fundamentally separates it from traditional operating systems. The idea of softwares as being locally installed tools that store, manipulate and display data using your own machines resources is done away with by Google. All these operations are instead shifted to the "cloud" i.e. application servers which perform the tasks of softwares but not on your machine, and are accessible in real-time via the internet.

In this respect the web apps or applications are the replacements for traditional software, and thus make the need for a traditional operating system redundant. These web-apps perform the same functions as their traditional software counterparts but are written in the language of the web such as JAVA, CSS and HTML, while traditional software is written mostly in C and C++ based languages. However, we know that even these traditional languages are in the process of being adapted for in-browser use

at a fraction of the original resources. This further blurs the line between traditional software and web applications.

Of course, an operating system also serves many other functions but all of those are only facilitators of the actions that the user wishes to perform. And if all those actions can be accomplished via the browser interface in an



effective and functional manner, it is clear that the benefits will outweigh the costs. The benefits themselves are extraordinary and we shall cover them in detail later on but what we lose is of equal importance.

The ability to tweak the operating system is completely taken out of the user's hands in Chrome OS. Since the system in its ideal state is designed from the firmware upwards, it can't be easily changed without risks to the overall system. And unlike updates in traditional operating systems, Chrome OS is upgraded compulsorily on a regular basis with no choice in the hands of the consumer. Since its release Chrome OS has already reached version 23 by 2014 and will continue to be upgraded with no option to rollback.

For many users, this form of computing may prove highly likeable since Chrome OS serves a broad and general user base such as kids, educational organisations, enterprise companies, governmental organisations and web-app developers. The lack of high end gaming and powerful graphic editing capabilities make it of no interest to professionals who require high resource softwares to perform their jobs. But it's very likely that as upgrades continue, internet bandwidth improves and new development takes place in language porting, we shall find web applications advanced enough to tackle all high resource intensive tasks on the cloud.

How Do Chrome OS and Chromium OS Differ?

Both the Chrome OS and Chromium OS are close cousins of the same family. The Chromium OS is actually an open sourced project that is favoured by developers with a code that can be customised and modified

by anyone to create a web-thin client for cloud computing. The Chrome OS is the name given to the operating system that original equipment manufacturer's or OEMs ship for Google under their proprietary brand for general consumers to use.

The differences between Google's Chrome OS and Chromium OS are simple but significant. Even though both are similar, Google has endowed Chrome OS with special privileges such as the licensing necessary to be able to run binary packages such as Flash, PDFs, 3G cellular data support and others. The machines made with Google's Chrome OS as a part of their firmware are called Chromebooks and are manufactured by major players such as Acer, Samsung, Lenovo and HP. These manufacturers design their Chromebooks in a variety of configurations but ensure that it conforms to Google's parameters for Chrome OS. These partnerships ensure that

Traditional Notebook vs. Chromebook

Items	Traditional notebook	Chromebook
Installing software	Can install programs.	Cannot install traditional desktop software. Instead of installing them, users can use the web-based applications.
Storing files	Can store files.	Users can use the web-based storage service.
Printing	Can install a printer driver on the computer, and then it can print.	Registers a the printer driver on Cloud Print and then it can print.
System updating	User updates the system manually.	Automatically updated.
Device connecting	Easy to connect the additional devices with USB port, wired network port, modem, DVI, etc.	Support a limited connectivity

Chrome OS performs at its peak by being directly tapped into the hardware of the device. This results in amazing speed, stability and security for these machines which can't be matched by any comparable product - all at an attractive price.

It's easy to imagine the evolving Chrome OS devices to be like laptop/smartphones hybrids in a way since like the iOS mobile devices the operating system is firmware based and can't be tweaked - unlike Android. The user experience is managed through web-apps in Chrome just like Apps from the iStore. But in the case of Chrome, most of these apps are tools for the user to work with their data using the user interface with the actual work being done non-locally in servers. Due to this off-loading of most work processes the Chrome OS device is like an internet appliance that "just works".

With a wide range of models, it includes all accessories pre-setup for maximum ease of use such as USB audio/video, GUI for Offline Apps, a SSH client, VPN support, support for a wide variety of external storage

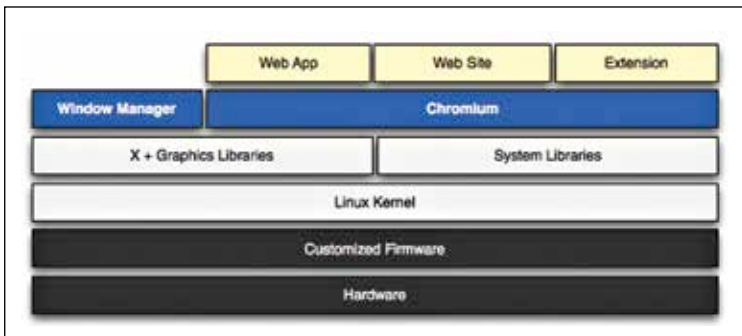
formats, support for majority of file types (no WMVs) and the support of external peripherals like projectors, USB accessories, Bluetooth devices, audio headsets, webcam, display ports and much more. In case of Chromium OS however, not all these functionalities come pre-packaged but can be set up piece meal via the in-built developer terminal. Apart from the core hardware dependency of Chrome OS and developer dependent tendency of Chromium OS, the two are virtually alike.

Chromebook OS: Speed, Security, Stability

The promise of Google's Chrome OS in the Chromebook is of speed, security and stability. And it is accomplished due to the very differences that make it more closed off than Chromium. This trade-off takes place at the hardware level its very unlikely that an open source Chromium OS build would be able to match its results - although it may come close.

As an internet appliance operating system Chrome requires zero maintenance from the user end and is attended to via Google's updates. The firmware build allows the system to have super fast booting and standby recovery which is unmatched in its category. The device is fairly foolproof because apart from physically breaking it there is no aspect to the operating system that can be disrupted like a Registry Editor or System files - it simply can't be misconfigured or wrecked due to its cloud and kernel based verifications. The second most important feature is perhaps its pricing, which has been determined by Google to be on the low side, with very thin profit margins, so that they can proliferate the device in the market. The most important feature is definitely that of security.

The method by which Google's Chrome OS sets up its impressive security features is very elegant. Every component of the Chrome OS device is



pre-defined and signed by Google so any non-authorised executable bit is purged if not verified by the device. This verified booting takes place to repair and resume operations in a seamless fashion for the user. Even in the case of bit rot (diminishing software performance) the verified boot switches to repair the operating system to its most recent version.

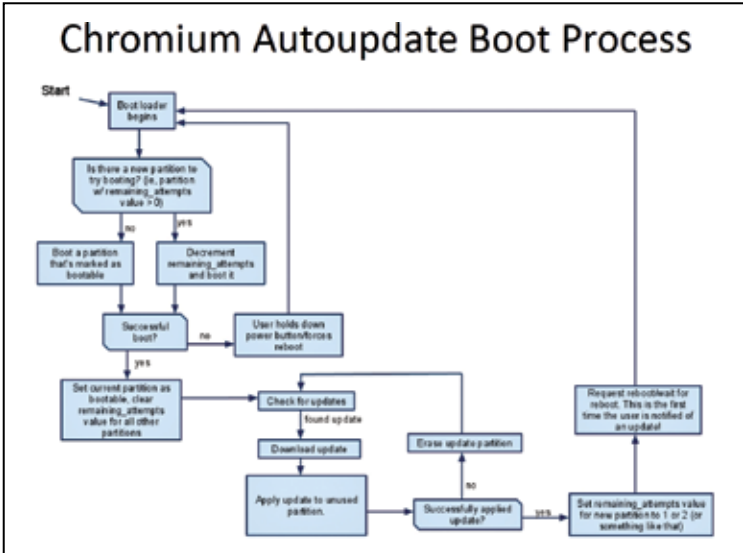
The customized firmware is further encrypted by Google's 8192-bit public key which is hard wired into the device at the factory stage which ensures that the PKI (public key infrastructure) chain of trust verifies the operating system as being untampered. This verification takes place on every start-up since the first part of the BIOS flash that is accessed is read-only. This read-only BIOS verifies the read-write BIOS and then executes it. The next step in the chain is the read-write BIOS verifying the kernel and executing that, which then verifies the roots of every block as it comes off the drive. This secured chain resets to Recovery mode if any of these steps is tampered with. In ideal conditions the whole start-up boot process to login takes seven seconds.

This extremely fast and secure booting allows the system to practically stay always on - which is how most people treat their online surfing habits. The added stability brought on by remote operating system upgrades allows the Chrome OS to be the perfect medium for data sensitive activities like online banking. It is also perfectly suited to the enterprise work environment where customised apps or subscription corporate apps are favoured to retain security within an organisation. In effect, the Chrome OS solves many of the Bring Your Device To Work problems by relying on Google's security features.

Chromebook, Chrome OS or Chromium OS?

We will go on to explain in later chapters how you can experience both Google's version of Chrome OS as well as the developer friendly open source Chromium OS. But it's abundantly clear that the true power and selling point of the Chrome OS can't be replicated fully when used as an upgrade to Chromium OS. The value of the Chrome OS is directly tied into two key features - internet connectivity and firmware design.

As hobbyists or experimental users, you can get a very accurate sense of what Chrome OS is all about by using it on your own devices. The immediate results themselves can be surprising to most users, since Chrome OS consolidates your user experience in a brand new way in to one window while giving you the familiar flexibility to play local media. As a casual user



interested in playing music, watching videos, streaming from the internet, surfing, chatting, emailing and using social media - you may find not even missing your former operating system. But of course, if you are yearning for the next high end game or looking to do cutting edge graphics editing, the Chrome OS isn't for you, nor was it meant to be.

In whichever case, its clear for all to see which way Google is heading with its foray into operating systems. As a creature of the web, it is not surprising then that Google would try and make its primary expertise a valuable tool in its attempts to connect deeper with users and their work experience. For many this change would be difficult, but its hard not to imagine that as internet connectivity increases, costs come down and speeds go up, the pace of web application development may actually make Chromebook type devices the next reality of computing. 



ARE YOU A CHROME PERSON?

Chrome OS is a completely new operating system and clearly, meant for a very specific user base. Find out if it's made for you. If it is, then stay a while to check out some handy shortcuts that will make using the Chrome OS a lot simpler.

The last couple of months have seen a fair amount of movement on the alternative OS front, for the want of simplicity and ease of use. Google pushed Android, as is, on certain AIOs recently and HP was leading that march. But, a much more refined alternative to Windows and Mac OS X is the new Chrome OS from Google. All laptops that come pre-loaded with Chrome OS are branded as Chromebooks, irrespective of brand or model. Currently, Acer, Samsung and HP are making some Chromebooks but surely, more laptop makers will join in in due course of time with a wider range of products.

But, it is more a case of expectation, to see how Chrome, as an operating system, works in a world where people have been mostly using Windows or Mac OS X for productivity and home / home-office use. But, for anyone who is looking to shift, do keep this in mind – it will be a major change, in some regards.

Usability, from the GO!

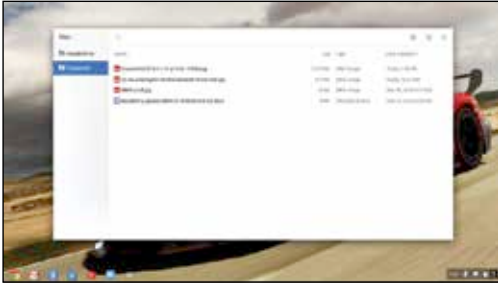
If you had chided Microsoft for the lack of the start button in Windows 8, this OS will possibly invite more snorts of derision. But then again, the purpose and the method of achieving the same purpose are completely different. And that is the learning curve with Chrome. Sign into your Google account, and what awaits you is the traditional desktop, but with a difference. On the taskbar (called Shelf, in this case) are the icons for Chrome browser, Gmail, Google Search, Google Docs and You Tube. If you use an Android phone, you will immediately recognize an icon very similar to the one that takes you to the app drawer. This is where the “apps” sit – stuff like the file manager, Tweet Deck or anything else that you may have downloaded.

For starters, and for all purposes, most of the stuff will run in the Chrome web browser. Too much Chrome branding to get confused with,



Not a lot is different from a user interface perspective

but bear with us! The base is the Chrome OS, while the quintessential window to the world of the Internets is the Chrome browser. You can download apps on the Chromebook, but they will almost always be web based versions.



File storage is a bit different and accessing files is also new

Dropbox? Web version. Pixlr image editor? Web version. Tweet Deck? Web version. Clicking on their icon / shortcut means the Chrome browser will open, with the relevant content. What you essentially need to

come to terms with is that most of these “apps” that you download from the Chrome store, are shortcuts to the web page. And that, for most users, is a major change.

What will not run in the web browser is the file manager / file browser – simply called Files. If you miss the folder structure traditional to Windows or Mac, this will bring some sense of familiarity. Two major tabs here – Google Drive and Downloads. On the top right of the window is the settings option, allowing you change the view, or create a new folder. Fairly basic, and should get most tasks done. However, we could not find a way to create more folders, apart from Drive and Downloads.

Who can switch over to a Chromebook, and who shouldn't...

When used as the primary machine at work for a few days, Chrome OS was a major learning curve. First, you need to get used to using Google Docs. Plus, the range of apps for Chrome OS is still limited, but worry not, because Angry Birds is there! Seriously though, if you are using the Google eco-system right now - Mail, Docs etc., and don't rely too much on third party software installed on the PC, then adopting the Chromebook should be the simplest task in the world.

For someone like me, who needs third party



Chromebook is for a certain type of PC user, not everyone

software like Irfan View (be it Windows or Mac), the change over isn't very smooth. For someone who has always used iWork and Microsoft Office suites, this is a change. Secondly, being heavily reliant on Dropbox shifting everything over to Google Drive is another step that you really have to take.

Cannot neglect the sheer advantages

As an OS, Chrome has its distinct advantages. It is simple, uncluttered, and to the point. On it's part, there are no pretensions of taking on Windows or OS X, and that is what makes this new platform so enticing. Chrome OS is meant for a very specific task, mind you. It's ideal for someone who is already using the Google ecosystem – browser, Mail, Drive etc., for their work. And also for someone who needs a simple to use laptop for web browsing, accessing emails, streaming media and playing the odd casual game.

Made up your mind? Memorize these shortcuts!

Since it is a new platform, getting used to how it works will take time. Given that reality, we have listed out five critical keyboard shortcuts that you must memorize (or pin up near the workstation!), to have a smoother transition.

Minimize Window - Ctrl + M

Quickly switching between windows? Minimize one quickly with this command to not waste time dragging the cursor over to the app icon.

Lock the screen - Ctrl + Shift + L

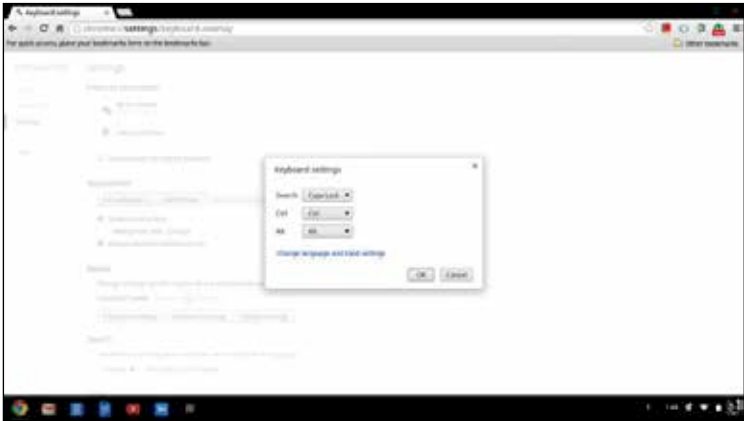
Leaving the desk in a hurry? This quick shortcut locks the display, and you will be able to unlock it, once you return, with your Google account password.

Task Manager - Shift + Esc

While we never once needed to view the task manager during our time with the Chromebook, if you notice that your Chromebook's performance has suddenly degraded, or the battery discharge is quicker than usual, you might want to check if an app is misbehaving. This command will open the task manager, showing each app's memory consumption, CPU use etc.

Toggle Caps Lock On/Off - Alt + Search

Well, this applies if you haven't changed the search key's behaviour in the settings. By default, as the name and the indicator suggests, the Search key opens the search tool. But, it sits exactly where the Caps Lock key sits on



Almost all of Chrome's (browser) shortcuts work just fine on the Chrome OS as well

almost every other laptop. If you leave this behaviour to default, the alt + search key combination will work for Caps Lock. Or, go into settings, and make this the Caps Lock key anyway.

Logout - Ctrl + Shift + Q (twice)

Again, one for those in a tearing hurry to rush to a meeting, press ctrl + shift twice in quick succession, and the machine logs off. 

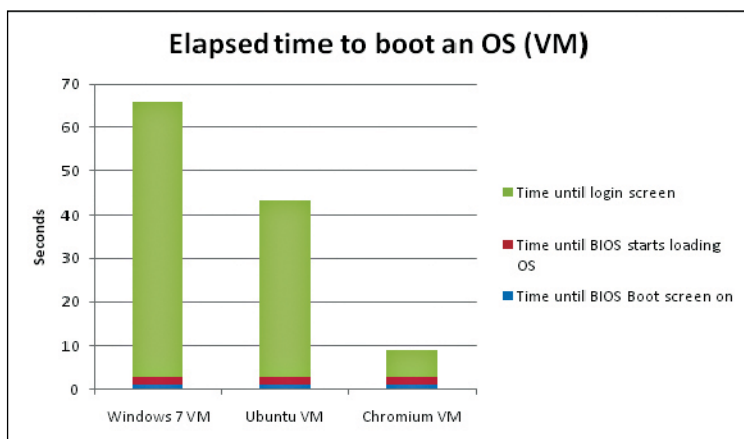


BEST OF BOTH WORLDS - DUAL BOOTING WITH CHROMIUM

It can be scary letting go of the familiar and unbearable not trying out the newest toy. So here is the simple way to set up Chrome OS on your current system along with your favourite operating system

As we've discussed in earlier chapters, Chrome OS and Chromium are two separate but related versions of the same operating system. Google Chrome OS is the officially supported operating system that comes hard-loaded on Chromebooks and has greater performance built into its design. Many features such as Flash, PDF, MP3 and MP4 support as well as update services are unique to Chrome OS due to Google's licensing deals and can't be found on the open source Chromium OS.

So it's important not to expect all the key points of a Chromebook, specially the super-fast booting load time. However, most of the other features can be loaded separately onto Chromium OS and there are certain update



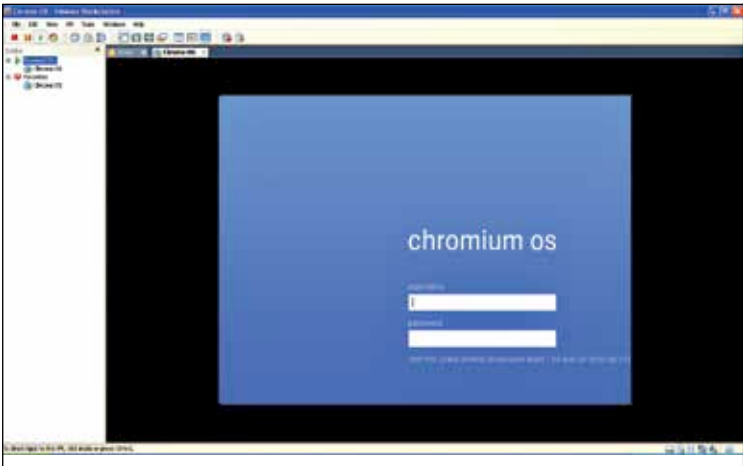
servers active that provide near-daily revisions to the operating system code in-sync with Chrome OS's updates. This effectively allows you to have a Chrome OS user-experience without having to purchase a Chromebook. But since these updates and features are supported by third-party developers there is no surety for how long they will continue. Caution should be taken in such a regard.

It is also important to note that since Google has built Chrome OS from the hardware up and its functionality is designed with the custom hardware found in Chromebooks. It is likely that some of you will encounter support issues when installing it on other hardware configurations. Many essential hardware features such as TrackPad, Wi-Fi and Power Usage options may are not supported by certain known models of HP Mini and Dell Mini

laptops (Wi-Fi compatibility problems), cause glitches on certain Lenovo and Acer machines (Wifi connectivity).

This installation was tested on four machines – Dell Inspiron 5520, Lenovo Thinkpad ___, MSI GTX660R and HP Mini to verify across the various systems. Most features are now supported but the Wifi stability still remains an issue on MSI and HP systems. However, these differences can vary depending on the specific model number. You can check to see if your existing machine or hardware components are on the list of supported devices at The Chromium Project website: [<http://www.chromium.org/chromium-os/getting-dev-hardware/dev-hardware-list>]

Resources needed



Installing Chrome OS isn't exactly a piece of cake, but it isn't difficult either

This guide is written with the assumption that you will be installing Chrome OS on a Windows system with access to all the necessary support softwares. This guide is equally applicable to Linux and Mac systems but hasn't been tested on them first hand. Before you jump into the workflow of setting up Chrome OS on your system make sure you have set up the following resources:

1. Access to an active and decently performing internet connection. A Wifi connection is preferable but Chrome OS also supports Ethernet network access.

2. Set up a Gmail and Google Drive account which you will use to run Chrome OS.
3. A blank USB drive with a capacity greater than 4GB.
4. Win32 Disk Imager [<http://tinyurl.com/bmmcm9r>]
5. 7-Zip File Manager [<http://www.7-zip.org/>]
6. Chrome Recovery Tool (optional) [<http://tinyurl.com/p2uykdt>]
7. Virtualbox - Virtual Machine Tool
 Windows: [<http://tinyurl.com/obnaous>]
 OSX: [<http://tinyurl.com/l89k3ar>]
 Virtualbox extensions: [<http://tinyurl.com/ll97eqx>]

It should be noted that Win32 Disk Imager and the 7-Zip File Manager are just recommendations and various alternative tools can be used for the same purpose.

The last and most important resource is the Chromium OS build which you will need to download. There are many variations of the build available in the open source community with their individual pros and cons. Also it should be known that when we refer to updating of the Chrome OS or Chromium OS, it is not an automatic in-OS update, but the release of a newer version of the OS. This means that if you wish to update the version of the OS you are using you will need to download it separately and switch over to it as your Chrome OS of choice. Given the quick and simple way of booting up Chrome OS via USB this isn't a bad option. But if you're installing Chrome to your device's hard disk then you may have to consider your options. The four recommended builds for either USB boot or Installation are:

1. Arnold the Bat Chrome build [<http://tinyurl.com/o74nl4t>] - 300MB - The most up to date build currently available on the net. It is updated daily and packs in many features including separate versions for ARM, x86 and x64 processors along with office Chrome OS firmware modules. The frequently (sometimes multiple versions per day) updated versions may present some stability issues but overall still the best option.
2. Hexxah's Vanilla Chrome build 4028 [<http://tinyurl.com/ybqdwye>] - 330MB - Occasionally updated with the latest build from April 2013. It is a plain vanilla build with very high stability. The great place to start for newbies.
3. Hexxah's Chrome OS-Lime build [<http://tinyurl.com/puk9q2z>] - 1.91GB - An abandoned build but has greater hardware support across many devices. Good for developers looking to work on Chromium without starting from scratch.

4. Dell's Chromium build [<http://tinyurl.com/yay5k7g>] - 313MB - No longer updated but compatible with Dell Mini and other models of Dell's hardware that may not be supported by other OS builds.



The Vanilla Chrome build promises to be as close to original as possible

Once all these files and software's have been obtained you are ready to begin the process of setting up Chrome OS or Chromium on to your system.

We shall be using the Hexxeh Vanilla Chrome build 4028 for the purposes of this guide but any of the suggested versions would work just as well. It's also important to note that Chrome OS and Chromium OS are not like traditional operating systems in most ways. The default and most popular way of using them is through a bootable USB or SD Cards. In case of true dual booting you need to have two separate hard disks since Chromium formats the entire hard drive with no option of making a partition before the formatting step.

Test Running Your Build

Before you begin making the bootable USB with your chosen build, it is always advisable to test run the version you've selected to make sure it's stable and functional. This isn't a critical step but recommended as it will save you a lot of time and effort in case your build isn't compatible with your system in a fundamental way. For this purpose we will be using a Virtual Machine setup.

The first step for this purpose is to download and install the most recent version of the Virtualbox installation file or any other virtual machine

application that you prefer. The installation wizard needs to be on default so don't worry about making any advanced selections. One of the final stages of the installation will give you an alert about Network Interfaces which will basically temporarily disconnect your network connections to configure the virtual network adaptors. The program will launch once installation is complete.

In this guide we're using Hexxeh's Vanilla build so you will have to download the VirtualBox build from Hexxeh's download page and save the Zip file to a Windows folder and extract it. Now with the Virtual Disk Image extracted you need to go back to the open VirtualBox application and click on the New button.

Next, you will give the Virtual Machine a name. Since Chrome OS is built from a Linux kernel you will need to set the type to Linux > Other Linux version. Now VirtualBox will present you with a slider that indicates the allocated memory to your virtual machine. It is recommended that you set it to 2GB and greater, but in case you're using an older system even 513MB will be sufficient. A good rule of thumb is to use 25 percent of your available RAM.



This will come in handy to test drive the OS before really installing it on a partition

Next you will need to load the Chrome OS Virtual Disk Image within VirtualBox. This can be done by choosing - Use an existing virtual drive file - option selecting the Virtual Disk Image that you extracted earlier. The next most important step before you're ready to launch Chrome OS within a virtual machine is to configure its network adaptor settings, otherwise you won't be able to access the internet.

Within the VirtualBox application you need to right click on the loaded Chrome OS image and select the Settings option or press Ctrl+S. This will present a new menu window where you have to select the Network option in the left panel and select the Advanced option. Now you can set the Adaptor Type, which in this case would be Intel PRO/1000 MT Desktop (82540M). If you know the exact adaptor type on your machine and find it in the drop down list then select that but the Intel PRO/1000 should be generic enough for most machines. Click OK and save the changes.

Now you are ready to launch the virtual machine with Chrome OS. In the main VirtualBox screen double left click on the Chrome OS image. The operating system will begin booting in the virtual machine but you may find that the mouse is not responding. This can be quickly fixed by selecting - Disable Mouse Integration - from the Machine menu at the top of the screen or by pressing the Ctrl+I. Once your mouse is active you're ready to take Chrome OS for a virtual test drive without having to worry about any conflicts with your default operating system.

Running from Bootable Removable Device

Typically an operating system is tested using a bootable USB such as with Ubuntu, but needs to be installed onto a machine's hard disk for maximum functionality. However, with Chromium this is not necessarily true. Since the maximum functionality of Chromium is via the internet and you can opt to have all your data and applications synced to your Google Account, the need for a hard installation isn't paramount. In such a case having a Chrome OS bootable USB or SD Card allows you to plug in to any networked machine and start your operating system directly. But if you wish to use the extended storage of your machine for data storage offline it is advisable to proceed with a complete dual boot. In both cases, the first step is to create a bootable USB or SD Card.

The first step in this process is to download the Chrome build of your choice. We are using Hexxeh's Vanilla Chrome build 4028. The downloadable file is a compressed Zip that needs to be unzipped using 7-Zip File

Manager to locate the IMG (.img) file. Using the Win32 Disk Imager software you need to place the .img file on to the USB or SD Card.

The next step requires you to go to your machine's boot setup options. The boot setup options can be accessed when your machine is turned on by pressing either the F2 or Del button. In case these two options don't work you can find the correct button displayed on the screen when your machine turns on. Users with Windows 7 or earlier need to find the option for Boot Device Priority in their BIOS menus and set it to Removable Device. In the case of Windows 8 users, this option is no longer available and has been simplified into the "boot options menu".



Does what it claims to do pretty well

Windows 8 users can configure their boot options in the following way:

1. Press [Windows Key + C] > Select Settings > Click on Change PC Settings > Select Generals Tab > Select Advanced Startup > Read the instructions > Click Restart Now
2. The computer will restart now and then the Choose An Option menu will appear on your screen > Select Troubleshoot > Select Advanced Options > Select UEFI Firmware Settings > Select Restart
3. For Windows 8 users the computer will restart with the BIOS settings screen > Find Boot Order option > Change boot order to Removable Devices as the first choice > Save and Exit.

Once your machine's BIOS has been set to detect and boot from Removable Devices then plug in the Bootable USB you have prepared and restart your computer. Chromium OS will boot directly from the USB and take a few minutes to set up. After this it will start and be ready for you to play around, sign into your Google Account, download apps, and explore. For all practical purposes Chromium OS is now active and running from your removable device, so anytime you wish to use it you just have restart your computer with the Chromium OS USB plugged in and you're good to go.

Installing to Hard Drive

Suppose you like your try out with the Bootable USB version of Chromium OS and want to make it a definite add on to your system - this is where a dual

boot option is needed. **WARNING:** We've said it before but keep in mind that in order to install Chromium OS you need a dedicated hard disk in your machine, partitions will not do. The installation process will format and erase



Follow the instructions on the screen astutely

your entire hard-disk and consolidate all your partitions. It's recommended that if your machine has two hard disks then you should back up one of them and make it your dedicated Chromium OS drive.

The steps to installing Chromium OS to your hard disk isn't that complicated once you have the Bootable USB made.

To begin you need to start your machine with the Chromium OS bootable USB. Once Chromium OS has started just follow these steps:

1. Press [Ctrl+Alt+T]. This will activate a command prompt that is known as the Crosh command prompt.
2. Type in "install" (without quotation marks) and the Enter key.
3. Chromium will now ask you to enter a username and password or just for a password. Depending on which build of Chromium OS you have chosen the password will be different and is found along with the version that you've chosen to download. The Username and Passwords for the builds recommended in this guide are:

	USERNAME	PASSWORD
Hexxeh's Chrome (Vanilla and Lime)	chromos	facepunch
Arnold the Bat	chronos	password
Dell's Build	chronos	dell1234

4. You will be asked for confirmation for the installation. Say yes and installation will begin.
5. The installation will happen automatically and you will be prompted when it is over. The next step is to power off the machine and unplug the bootable USB after which just reboot the machine to confirm the installation.

That's it. Now every time your computer starts you will be asked to select between which of the two operating systems you wish to launch. In case you've chosen to dedicate your machine to Chromium OS then it will directly start without prompting.

From Chromium to Chrome OS

Now that you've successfully installed Chromium OS you have the option of upgrading it to one of Google's official Chrome OS builds that have been released for Chromebook users. By following the next series of steps you will successfully have the latest available version of Chrome OS which is at par with those of

Chromebook users. **WARNING:** The versions of Google's Chrome that are mentioned in the following section have been customised to specific hardware configurations and you will have to select the one that closest matches your machine. There is a fair likelihood that



The switch from Chromium to Chrome OS is an easy one

some hardware features may not work or behave erratically. Or you could get really lucky and have a very smooth experience.

1. Start up your machine and wait for Chromium OS to load. Log in with your account and not the guest account feature.
2. Press [Ctrl+Alt+F2]. This will bring up the developer console to the screen.
3. Type in: `sudo su` and press Enter.
4. Enter username/password as mentioned in the prior section.
5. Type in: `wget http://goo.gl4subf; sudo bash 4subf`
6. Press Enter. After a bit of loading time your screen will display a list of all the available Chrome OS builds available for installation.
7. Match the right build for your machine based on brand name such as Acer or Samsung. Its important to note that although brand based selection is the simplest way to choose, you may find better compatibility with some other options as well. You may consider experimenting at

this stage as you can always roll back without much effort later on. Be mindful when choosing between 32-bit and 64-bit versions.

8. Once you've selected your version type in the build number and press Enter.
9. This will start the download and installation process of the Chrome OS.

Once the download finishes the machine will reboot and you will restart with the official Google Chrome OS running on your system.

Loading Codecs

As we mentioned earlier the open source builds of Chromium OS do not come packaged with all the features as does Google's Chrome OS. In order to make your version of Chrome OS fully compatible it needs to be loaded with drivers or codecs. The method of updating your build with the latest codes is simple and can be accomplished in the following steps:

1. Log into Chrome OS with your account.
2. Bring up the developer terminal by pressing [Ctrl+Alt+F2]
3. Type in: `sudo su` and press Enter.
4. Enter your username and password for the build.
5. Type in: `curl -L http://goo.gl/reX3Z | bash`
6. The codecs will begin downloading and installing on your system.
7. Restart your system once the installation is complete.
8. Verify your plugins by opening Chrome browser or main window. Type in: `chrome://plugins` and press Enter
9. A list of all the installed codecs and plugins will appear on your screen. You can set individual permissions for each codec. It is advisable to set all of them to "always allowed".

Wireless Card Troubleshooting

All this while you have either had the good luck to have a functional wireless connection for the downloads and installations on Chromium OS or have managed to use an Ethernet connection to proceed this far. In this section we will outline the currently available method of activating your wireless card with Chrome. At present the biggest issue is with Broadcom wireless cards and the below method is for dealing with that particular brand, but may also work with other non-functional brands of wireless cards.

1. Login to Chrome using your account.
2. Press [Ctrl+Alt+F2] for the developer terminal
3. Type in:

Targeting web users with video: only HTML/H.264 works nearly everywhere

Browser and share		Flash/H.264 Most PCs, few mobiles	HTML5/H.264 Most PCs, most mobiles	HTML5/WebM Some PCs, few mobiles
	Chrome Desktop browser	Yes via built in support	No (soon) Yes with plugins or on Windows or Mac OS X	Yes
	Firefox Desktop browser	Yes via bundled Adobe plugin	No Yes with plugins or on Windows or Mac OS X	Yes
	Opera Desktop browser	Yes via bundled Adobe plugin	No Yes with plugins or on Windows or Mac OS X	Yes
	Internet Explorer Desktop browser	No Yes with Adobe plugin, installs via ActiveX	Yes	No Yes with Google plugin
	Safari Desktop browser	No Yes with Adobe plugin, new users install manually	Yes	No Yes with Google plugin
	Mobile Safari & most other mobile browsers	No No plugins	Yes	No No plugins

```

sudo su
mount -o remount, rw /
sudo echo "blacklist b43" >> /etc/modprobe.d/blacklist.conf
sudo echo "blacklist b43legacy" >> /etc/modprobe.d/blacklist.conf
sudo echo "blacklist ssb" >> /etc/modprobe.d/blacklist.conf
sudo echo "blacklist bcma" >> /etc/modprobe.d/blacklist.conf
sudo echo "wl" >> /etc/modules
sudo touch /etc/modprobe.d/wl.conf
sudo echo "alias wlanO wl" >> /etc/modprobe.d/wl.conf
cd /lib/modules/3.4.0/kernel/drivers/net/wireless/
wget http://cbromium.arnoldthebat.co.uk/files/fw/lib/modules/3.4.0/kernel/drivers/net/wireless/wl.ko
sudo insmod /lib/modules/3.4.0/kernel/net/wireless/cfg80211.ko
sudo insmod /lib/modules/3.4.0/kernel/net/wireless/lib80211.ko
sudo insmod /lib/modules/3.4.0/kernel/net/wireless/lib80211_crypt_ccmp.ko
sudo insmod /lib/modules/3.4.0/kernel/net/wireless/lib80211_crypt_tkip.ko
sudo insmod /lib/modules/3.4.0/kernel/net/wireless/lib80211_crypt_wep.ko

```

```
sudo insmod /lib/modules/3.4.0/kernel/drivers/net/wireless/wl.ko
sudo depmod -a
```

On executing the above command you will find that Chrome OS can now detect wireless networks having successfully partnered with your wireless card.

On Dell machines wireless card detection can be managed in the following way:

1. Login to Chrome using your account.
2. Press [Ctrl+Alt+F2] for the developer terminal
3. Type in: `cd /etc` and press Enter
4. Type in: `sudo -s` and press Enter
5. Type in: `.install_wl.sh` and press Enter.

This should install the drivers necessary to access the wireless card on your machine.

TrackPad/TouchPad Issue Troubleshooting



Touch input is supported on Chrome OS. Definitely give it a try.

In rare cases there are known to be glitches with the touch pad of a laptop. The following steps will help solve this problem.

1. Login to Chrome using your account.
2. Press [Ctrl+Alt+F2] for the developer terminal

3. Type in:

```
sudo su
mount -o remount, rw /
cp /etc/X11/xorg.conf.d/50-touchpad-cmt.conf /etc/X11/xorg.conf.d/50-
touchpad-cmt.conf.bak
rm /etc/X11/xorg.conf.d/50-touchpad-cmt.conf
cd /etc/X11/xorg.conf.d/
wget http://chromium.arnoldthebat.co.uk/files/fw/etc/X11/xorg.conf.d/50-
touchpad-cmt.conf
```

4. Reboot your machine.

You may find that the mouse pointer disappears when you're not using the mouse. No need for alarm as this is just a glitch of the build and the cursor reappears when you move the mouse.

For machines that use Synaptics touchpad drivers the steps are a lot simpler.

1. Login to Chrome using your account.
2. Press [Ctrl+Alt+F2] for the developer terminal
3. Type in: `sudo su` and you will be asked for a password. Type password and press Enter.
4. Type in: `wget -qO- http://goo.gl/1VWYcc | sh`
5. Reboot your device. Done.

Sound Fault Troubleshooting

In case your sound card codecs haven't activated you can follow these steps:

1. Login to Chrome using your account.
2. Press [Ctrl+Alt+F2] for the developer terminal
3. Type in:


```
$ mount -o remount, rw /
$ alsacnf
```

That's it. Just restart your system and the sound should be active.

JAVA Support Troubleshooting

In case your JAVA Flash isn't working in Chrome OS take the following steps:

1. Login to Chrome using your account.
2. Press [Ctrl+Alt+F2] for the developer terminal
3. Type in:


```
## Setup java
if [ `uname -m` == 'x86_64' ]; then
```



JAVA, the most installed, most used software in the world. Hands down!

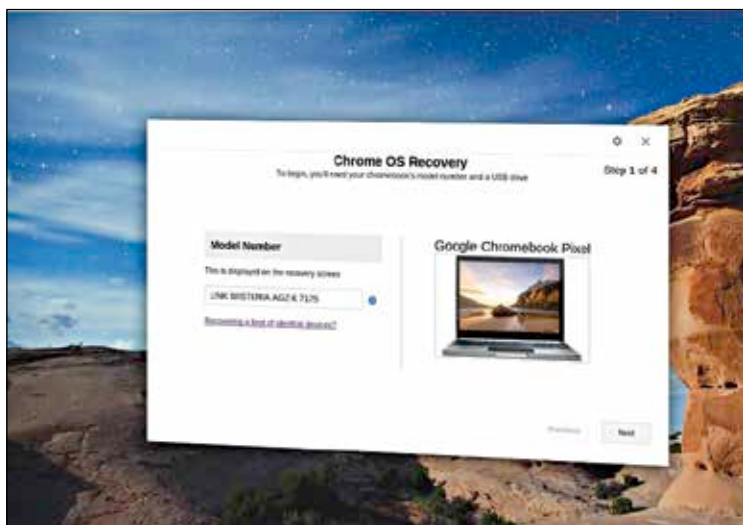
```
PATH="/usr/lib64/jvm/java-7-oracle/jre/bin/"
JAVA_HOME="/usr/lib64/jvm/java-7-oracle/"
else
PATH="/usr/lib/jvm/java-7-oracle/jre/bin/"
JAVA_HOME="/usr/lib/jvm/java-7-oracle/"
fi
```

If the above command code doesn't work then you can follow the first two steps to reach the developer terminal and enter the following:

```
FILE_NAME=/opt/google/chrome/pepper/libpepflashplayer.so
PLUGIN_NAME="Shockwave Flash"
VERSION="11.3.31.318"
VISIBLE_VERSION="11.3 r31"
DESCRIPTION="$PLUGIN_NAME $VISIBLE_VERSION"
MIME_TYPES="application/x-shockwave-flash"
```

Chromebook Recovery Tool

In a typical Chromebook the Recovery Tool is a default feature but you can make a recovery backup by simply going to the main Chrome window. Be sure to have a 4GB or greater blank USB plugged into your system and type in the following in the address bar for any tab: [chrome://imageburner]. The



Doing software recovery on the Chrome OS isn't that big a deal

Chromebook Recovery Tool will automatically start and guide you step by step towards making your own recovery device. That's it. 

Disclaimer: This guide is a general approach to enabling the use of Chromium and Chrome OS on any existing computer hardware. Be warned that most of the work behind these processes is still ongoing and in no way guaranteed to work on all hardware configurations. As with all operating system installs there is an inherent element of risk and Digit magazine in no way takes responsibility for any loss or damage to data or machine components that may result from following these instructions. It is highly recommended that all critical files and data be backed up on an external source when experimenting with the installation of a new operating system.



SALVAGING A CHROMEBOOK AND MAKING YOUR PERSONAL CLOUD

In the age of cloud computing hardware ceases to be a major restriction for commonly needed daily tasks. You can easily repurpose old laptop and desktop systems to work faster and smoother with Chrome OS. We show you how.

Given the rapid pace of technological development and the monthly releases of newer personal computing devices, the rate at which people upgrade computers is rapidly increasing. With nearly 500 million units of computer devices like laptops, desktops, netbooks and ultrabooks being sold every year the amount of technology that is discarded in the name of upgrades is tremendous. In America alone over 100,000 computers are discarded everyday. In most cases the reason behind such trashing is the inability of the hardware to keep up with software developments in operating system usage and gaming.

But in the age of cloud computing the appliance model behind Chrome OS has gone a long way to making us question the need for frequent upgrades. It is true that persons in specialised fields will continue to upgrade their hardware to keep up with their basic requirements, but casual users who use computers for emailing, media viewing, surfing the net and working on office suites, don't have to discard their old machines just because the latest version of their office suite slows the system down. And if you have any old systems still creaking away you can breathe new life into them and see the surprising rejuvenation that the Chrome OS can bring to their functionality.

Revitalising Old Devices

A key reason to consider using an older or obsolete machine for your first Chromebook has to do with intent of use and cost savings. Even if you wish to invest in a very low end computing device like a 20,000 rupees netbook, you know that it will come with added deferred expenses in the form of a fully featured antivirus or office suite. In addition to which it will most likely lack an optical drive and have very limited onboard storage. But if you have an outdated machine (even five or ten years old) which still has its storage, RAM and processor intact you are set to have a wonderful Chrome OS experience which will allow you access to cloud apps that can accomplish most everyday tasks.



Making the most out of old devices is a skill that's useful

Having read the earlier chapters you must've reached a clear idea of what features and functionality you can expect from a Chrome OS experience. Connecting those aspects to an "outdated" machine - laptop or desktop - doesn't significantly change its operations in any way and is a great way to pass down technology to others like kids for educational purposes, where the need to be connected to the internet is high or to repurpose it as a home office set up which is connected to your office files via the cloud. The possibilities of how you can reorient your homelife to stay connected via WiFi across different rooms and even different cities (depending on your internet connectivity).

The only assumptions we make in this guide is that your older machines still have functional access to either Ethernet or WiFi connections, and have all the basic necessary components in working order. Apart from the minimum system requirements described next it is also worth having your old system serviced at least once to make sure that its Ethernet and WiFi connectivity is still compatible to the current standards. If your network adaptors are not capable of supporting current network speeds on cable, broadband and Wi-Fi, then the project as a whole would not be of much good. The only thing you would need to do next is wipe the settled dust off the machine and get it cleaned up for its marriage with Chrome OS.

Minimum system requirements

The Chrome OS architecture is very scalable and is already found on a variety of hardware configurations in the Chromebook, Chromestation and Chromedesk formats. So there are very limited considerations for its minimum requirements when considering it for an older system. Looking at the prepackaged systems from Google you can easily expect a smooth experience with just 2GB of RAM, a 1.4 GHz processor and 16GB of storage. However, in our tests we have seen Chromium OS work satisfactorily with 512MB of RAM, 1.4 GHz processor and 8GB of storage as well.

If you intend on using the Chrome OS enabled device for kids and basic office functionality the latter described configuration would be perfect. Otherwise 2GB of RAM would be recommended with 8GB or greater storage. It's important to remember that some key features of Chrome OS such as its famed super fast booting and standby features can't be replicated without the proprietary hardware used by Google in its Chromebooks. But as far as a cost effective cloud connected appliance computer is concerned you can't go wrong with Chrome OS on any outdated machine - laptop or desktop.

Be sure to back up any content from your old computers storage that you might need as Chrome OS would format and erase your hard disk in order to be set up. It's not recommended that you attempt a dual boot system with Chrome OS and older operating systems as not only would it force



Unlike other full-fledged operating systems, the minimum system requirements for Chrome OS is really minimum

you to have separate hard disks (unlikely in older computers) but also tax the memory processes during booting, slowing down your Chrome OS experience. The specific method of setting up Chrome OS or Chromium OS on your hardware is exactly the same as described in the earlier chapter. First, create a bootable USB using your current computer so as to test out the operating system on your old machine and once you are satisfied you can proceed to installing it.

The installation process can be done directly to the hard disk and you can proceed to set up all of the necessary codecs and features as they've been described. It is highly possible that you may face hardware compatibility on a few key hardware components, from wireless adaptors to the mouse interface. But you'd be surprised to discover that if any of our troubleshooting solutions don't work for you, there are customised fixes for a variety of hardware systems online – especially on the Chromium OS developer forums where you can even request help for your specific hardware models. In this respect, it is always helpful to have a detailed list of your hardware component models since due to their age, the fix has already been developed somewhere online.

One computer many devices

Now that you have set up your old machine with Chrome OS the question comes how best can you use it. There are a variety of approaches you can take – from home networking to office-home networks – all of which are

driven using your Google Accounts and Drive connectivity. By installing various third party apps on your devices you can further improve the performance and functionality of your new networked machine. Take some time to consider your environment, needs and capabilities to imagine the best solutions for your lifestyle. We suggest a few ideas which can prove valuable irrespective of how you employ them.

Your new Chrome machine can be used as an extension of your primary computer wherever you are and whatever you do. Suppose your primary computer is in the office and its where most of your work happens. Simply connect the data and content from your office computer to

your Chrome machine via Google Drive or Remote Accessing features, and even the Chrome machine will become an extension of your office computer at home.



Chromebooks are poised to enter your digital world

The recovered Chrome machine is also a great means to allow kids to access the internet for studies and fun without the distracting problem

of overt gaming. Since the Chrome OS doesn't support the installation of any outside applications, you can be sure that the device will perform well for work without proving too much of a distraction because of games. In fact, using the primary Account Settings, you can supervise, restrict and control the access children have to the internet thereby making the Chrome machine into a purely study based device. With occasional furloughs for online gaming perhaps as a reward.

The third and perhaps most ambitious use of the recovered machines is to create a home device network. This is only possible if you happen to have more than two old machines on which you are using Chrome OS. If that is the case you can have each device anchored to a room in your house and use it a manner of interesting ways – virtual intercom, inter-room video chatting, video monitoring (if a machine has a webcam), fluid work environment where you can resume work in any location, convergent notes, media sharing and so much more.

This concept works best if you can sling your Chrome machines together using the OpenVPN connection system that is built in to Chrome OS or any other service you may like from the Google Web Store. It is especially useful if you wish to connect a machine to your TV via HDMI and give your TV an operating system of sorts. In this respect it is advisable to keep track of the newer builds of Chromium OS and Chrome OS that are being released by the online community. Remember that Chromium OS has a lot more third party apps which aren't available on the Web Store. If your machine storage doesn't have any sensitive or important data then it's worth the risk of testing these new community developed features out. Newer and yet to be released apps are moving towards a variety of integrations within the Chrome OS architecture and it can be a treasure trove of functionality for those with imagination.

Setting Up A Personal Cloud

Given the networked connectivity of a multi-Chrome OS machine system it is worth looking into the use of the extra storage beyond locational limits. Having successfully set up Chrome OS on even two machines, one at home and one away, you can benefit from their combined storage in a number of ways. Using high speed broadband internet connectivity at even 1 Mbps speeds it's possible to access your files, documents, images and music over the internet with ease. There are many options as to how you can go about doing so and we shall briefly cover them now.

The first step would be to run a speed test on the various internet connections available to your machines, from homes to offices and other locations from where you can foresee needing to access your files. Once the speed benchmarks are met you can expect a smoother file transfer experience. Unlike the 15GB free storage that is available on Google Accounts and various other online storage services, we are going to look towards the hard storage drives that you have in your old machines along with any external hard disks that are connected to them. This is a far more cost effective method of owning data as cloud based storage is subscription based and can run up huge costs in the long run especially with dense data files like videos.

The first step towards setting up your own personal Chrome OS cloud is to ensure that the routers you are using are capable of connecting multiple devices. Older routers need to be manually configured with the required Port Forwarding settings, which differ from model to model in setting up a private cloud. We shall be dealing with Universal Plug and Play (UPnP) enabled

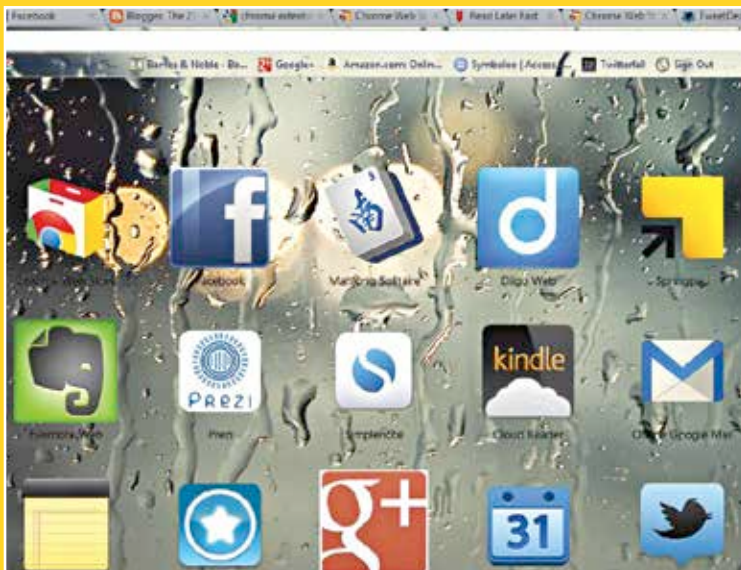


You can sync pictures, videos, documents and other files across various devices

as well as one other computer. Comparatively, you can also consider using software enabled extended storage devices like the Western Digital MyCloud external hard disks. These devices not only give your massive extra storage at reasonable prices but also come with an onboard DLNA media server software which essentially allows you to access data on it via wireless devices.

But for those who want to do it free and rough, in the second scenario with your salvaged Chrome OS machine serving as the personal cloud, the best option available is the ownCloud software and Chrome extension. So far ownCloud hasn't been ported to Chrome OS but can be accessed via URLs on other machines for back and forth data transfers. The system can be set up fairly quickly and accessing it only requires you to know the IP address of the host computer and the assigned port. It is a slower option compared to the paid for services as it takes time to scan and index all your data but once you've managed to set it up it works surprisingly well for a free option.

The Chrome OS outside of Google's Chromebook type devices is untethered and constantly evolving. The developer community continues to create and release patches and options that enhance its connectivity features making the idea of cloud computing more personal and seamless. The key to making the most of your Chromebooks is to constantly keep experimenting with the system by following up on newer builds and add-ons, you will be surprised as to what you may discover as Chrome OS gains even more popularity. 



MUST HAVE APPS FOR A CHROMETASTIC EXPERIENCE

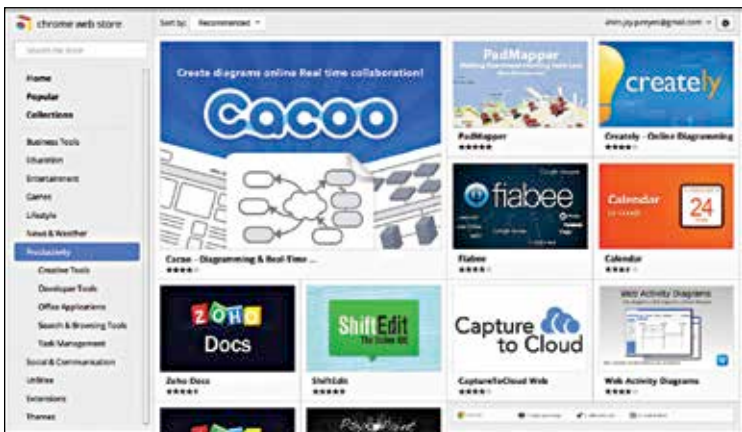
Chrome OS without the right apps is just a very pretty paperweight. And with the right apps you can do so much – we walk you through all your choices in work, games, media, social and more.

Once you've set up your Chromebook or Chrome OS system on your own machine the next step is setting up all of your applications. The typical Chromebook OS comes bundled with a variety of apps that make it easy for you hit the ground running and get things done. The list of apps that can be found on a Chromebook are easily available through the Google Web Store and can be loaded onto your own version of Chromium OS or Chrome OS. The default apps include: Google Web Store, Google Search, YouTube, Gmail, Google Calendar, Google Maps, Google Drive, Google Docs, Google Sheets, Google Slides, Google+, Hangouts, Google Play, Google Play Books, Google Play Movies, Calculator, Camera, Chrome Remote Desktop, Chrome+ Photos and Google Keep.

But if your needs are a bit more in-depth, such as in case of social media apps, enterprise level work apps, media editing and gaming, you will find yourself browsing around the Web Store to find the right apps. We hope to get you started with the following list of reviewed apps across the major categories.

Work Evernote

If you're already familiar with Evernote then you already know how invaluable it can be. If you've never used Evernote, then you will thank us for introducing you to it. The award winning service is now available as a full blown Chrome app and can be used across not only the Chrome OS but also synced to your mobile devices. The Evernote app is a handy tool that



The Chrome webstore is a well-equipped repository of apps and services

allows you to save not only your ideas and thoughts in multimedia notes, encompassing video, text and audio, but also anything that you wish to tuck away for later while browsing the web. The Evernote app is specially useful when you're surfing the web for research and its elegant user interface allows you to quickly and intuitively save the relevant snippets of media from web pages into a neatly organised format which you can customise. The service also allows you to create to-do task lists, reminders, project folders and provides you with a unique email ID to which you can email anything which would automatically be added to your Evernote folders. Across tablets, mobile phones and the Chrome OS, Evernote gives you a seamless user experience where all your data is securely placed in a generous storage cloud.

Zoho Office Apps

Even though Chrome OS can be used with Google's own Docs and Drive feature to accomplish most everyday office tasks some users may wish to go a different way and try something with a bit more power. This is where the functionality of the Zoho Office apps in Chrome OS makes all the difference. Zoho office productivity apps not only cover the usual Writer, Sheets and Show (presentation maker) apps but also provide you with a nifty customer relationship manager (CRM) which can prove very handy for small business' who don't wish to shell out the big bucks for brand name CRM solutions like SAP. The Zoho Writer app is the word processing app that operates on the cloud allowing you to access, share and edit your documents from anywhere. The surprising speed with which it connects you to your work makes it a sure fire winner for any office setting especially given its highly effective collaboration features such as commenting and chat service which allows real-time multi-user access. All these features are also found in the spreadsheet application called Zoho Sheet which has functionality for all types of users, from students to scientists, with all the business and accounting tools built in to the app. Almost everything that you may expect from an office suite can be found in the Zoho Office Apps saving you money by opting away from Microsoft's subscription or paid office suites.

SlideRocket

Every office productivity suite needs an impressive presentation maker. And even though Google Docs and even Zoho offer highly functional presentation applications, the one we would recommend is SlideRocket. The SlideRocket

app lets you truly make the most of the presentation format, ensuring you are able to impress your audience with style as well as substance. The app comes with large number of pre-designed templates and styles that lets you create great looking presentations every time. The app with its HTML5 support makes sharing presentations on iOS devices a breeze and comes bundled with unique analytic tools that allow you to measure the impact of your presentation on the audience and gauge audience engagement. SlideRocket takes full advantage of its HTML5 support structure as it quickly and effortlessly allows you to integrate multimedia files such as video and audio in to your presentations without any glitches or errors.

Wunderlist

Sometimes the best apps are those that not only do their job well, but look good doing them. In that respect Wunderlist is one of those apps that just great to have because of its awesome user interface and design. A hardcore productivity app, Wunderlist is basically an online to-do task list that allows you to sync, update and share activities and tasks across work groups or even family members.

Using push updates, email alerts, in-app notifications and many other seamless features that ensure that your workflow remains on track – a great tool when you're working with any number of people in a co-ordinated project that requires constant back and forth of



Create lists after lists after lists. It's fun, so why not?

task scheduling. Much like a project management tool, Wunderlist connects your tasks with your human capital resources and eases the lines of communication. But more than that the reason Wunderlist stands out is its beautiful design, multi-platform connectivity and mobile device integration. It's the next generation of the simple old school to-do checklist app.

ShiftEdit

Now we move on to some serious niche productivity tools that will be of definite interest to developers. ShiftEdit is an online based integrated devel-

opment environment or IDE that is an essential tool for cloud developers on the Chrome OS system who wish to use the efficiency of the Linux base to develop across multiple platforms. In contrast to desktop based integrated development environment tools like Netbeans, the cloud based ShiftEdit is designed to be an effective replacement in a web application format. The app takes advantage of the system architecture of Chrome OS along with its cloud based design to let developers seamlessly work on projects from anywhere at anytime on any device they wish. The app is specifically oriented towards web based languages such as HTML5, PHP and Ruby among others. Without the need for individual system installations ShiftEdit comes as a free app that can also be used offline without internet support and then sync back to the cloud when a network connection is available. Another key feature useful for developers is its autocomplete option is compatible across languages and supports a diverse range of server types making it a perfect web based IDE.

Less Annoying CRM

The humorously named customer relationship management app called Less Annoying CRM does exactly as advertised. The web app is intended for small business users who wish to have a simple and intuitive user interface within an affordable price range along with an excellent customer service. The CRM app allows users to manage all their business information, such



This is exactly what it claims to be – a less annoying version of CRM software

as contacts, sales leads, notes, dates, schedules, task lists and many other essential business features within a single easy to use interface. The web allows users to not only run the CRM from their Chrome OS but also collaborate with numerous other devices such as Android, iOS, Blackberry and Windows based phones, making enterprise connectivity fully functional. The app also comes with an easy to understand video tutorial that lets first time CRM users quickly get the hang of how to use the application. It can be tried out for a 30 day free trial with a USD 10 per month subscription with no strings attached.

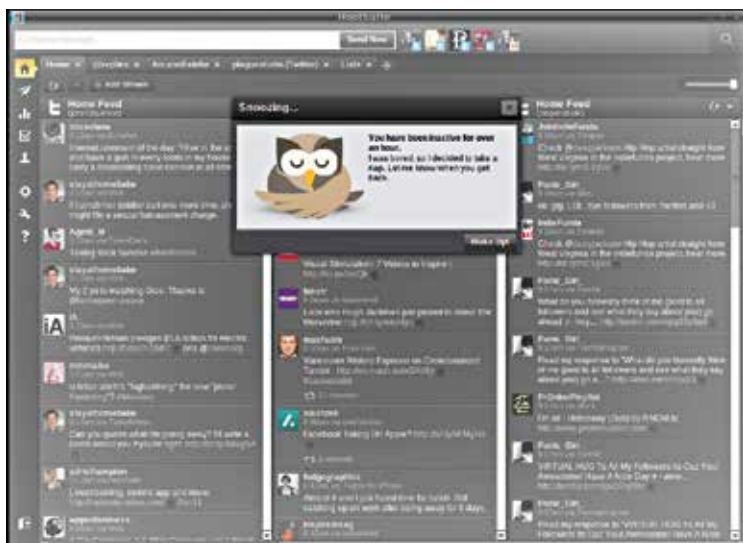
Social

IMO messenger

With the proliferation of mobile devices the need for instant messaging tools has only increased and the IMO messenger is a great Chrome OS based web app to get you connected. The messenger app allows users to connect with their contacts across various services and platforms such as Yahoo, Facebook, Skype, MSN Messenger, Google Talk and many more. The app is also designed to support more than just text messaging with video and audio capabilities as well. The web app service is offered free and doesn't even demand a user registration to start working. The added benefit of saved chat histories is also seamlessly available over the cloud from any device and makes the sending/receiving of media files easy. Users can even make Chrome OS to mobile video calls and run multiple chat sessions across different platforms. The chats seamless shift from OS to mobile device allowing you to continue a conversation on the go, which can be invaluable for both business and pleasure.

HootSuite

The HootSuite service is an already popular social media dashboard application that is used by users of Twitter, Facebook and other platforms. Now the service is available as a Chrome OS web based app that lets users not only manage their many social media networks but also use real-time searches and track results directly from Chrome OS. The uniquely designed dashboard interface allows users to set up and schedule their messages on Twitter, Facebook, LinkedIn, Foursquare, Wordpress and many other sites in advance. The app also allows users to track the emerging trends and topics across networks and view analytic results all from the same interface without having to switch between different social network pages.



Take charge of your social media feeds with HootSuite, a dedicated tool with analytics

The HootSuite app also allows users to detect and analyse their audiences demographics, information, social influence, presence and publishing habits to make the most of social media as a business tool as well.

TweetDeck

Just like HootSuite, the award winning TweetDeck service is also available on the Chrome OS. Performing many of the same functions as HootSuite, the newly redesigned TweetDeck application makes for a powerful tool in the hands of a social media user, whether its for personal or business use. The multi-platform support across social networks along with the ability to customise the layout of the application allows users to streamline their experience to focus on exactly what they need. The app also support all media formats as needed in the form of tweets, updates and messages, with the analytic insight support for which it is well known.

ScribeFire

Users who are deeply invested in their blogs will surely have heard of ScribeFire, that was originally available on Firefox. Now with Chrome OS and the Web store's popularity, the highly desirable blogging app is now available as a web app. The fully featured blog editor allows your cross-

platform connectivity to numerous blog sites. Whether you are a WordPress user or a Blogger, ScribeFire supports both along with TypePad, Windows Live Spaces, Xanga, LiveJournal and any other blogging site based on the MetaWeblog or MovableType APIs. The web app allows you to edit, update, schedule and write your posts through a single browser interface. The app is also fully supportive of media uploads to any of the platforms as well as layout options that allow you to tinker with the page code to make any changes in HTML or Markdown language. The web based cloud functionality of ScribeFire makes the most of the Chrome OS ecosystem preserving all your data making it accessible from numerous devices.

Media

Pixlr

Even as Chrome OS and Chromebook system disallow the installation of many popular softwares, specially consumer based ones like Adobe Photoshop for image editing, the availability of web apps such as Pixlr more than makes up for the loss. The powerful Pixlr Image editor is a fully featured image editing app that runs in Chrome OS through the browser web app while giving the same quality of results you would expect from Photoshop. Lacking some of the deeper features of professional photo editing softwares, the Pixlr webapp is the most many users would ever need as it is free to use



This is quite literally the most advanced, free, online image editing tool

and ready to use from the first click. It is already the most popular image editing web app available and for good reason as its finer features come very close to the expensive paid for softwares. Essential tools such as red eye reduction, spot healing, drawing, clone tools, sharpen and blur options are included along with the ever increasing filter options like HDR, glow, tilt-shift, vignette etc. The web app is also powerful enough to let you make Photoshop like adjustments using Levels, Curves, Process and others. It can even work on saved Photoshop Design files (PSD) and resume most edits.

WeVideo

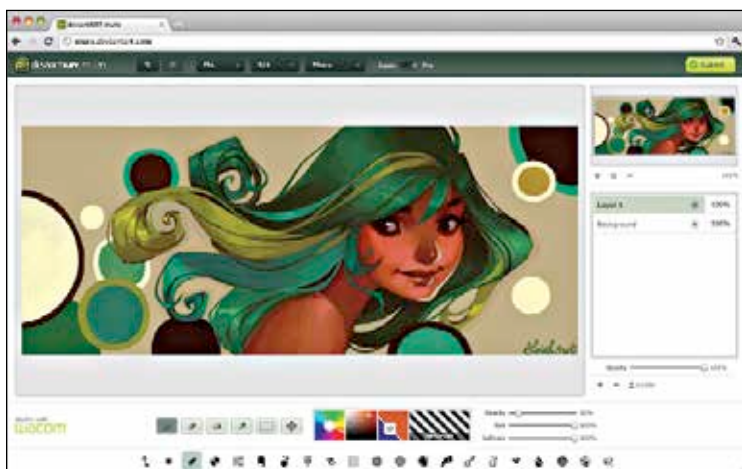
The computing world has come a long way from Windows Movie Editor with the release of numerous amateur and professional video editing tools. And for many the assumption would be that editing on a Chromebook type system wouldn't be possible due to its installation restriction but with WeVideo web app this is not true. The WeVideo web app is a surprisingly efficient video editing tool that runs right through the browser of Chrome OS with three separate editing modes which covers the range of user expertise. The operation of the app is easy as media files just need to be drag and dropped into the interface timeline and get to work. It is the only truly cloud based video editing app that works across any device while providing an adaptive interface making the creating of videos easy. The WeVideo app also comes with a DropBox and social media connection which allows you to easily pull media from your social networks and online storage – including Google Drive - which allows for shared editing and collaboration. The app is free to use but charges money on a per video export basis ranging from US \$0.99 to US \$1.99.

Audio Editor by Aviary (Aviary Design Suite)

Just like video editing the use of audio editing programs has also become more popular and with the Audio Editor by Aviary it can be run right off the Chrome OS using the web app. The powerful editing tool can be easily used to import audio files directly into the editing timeline and create your own mix. The web app also supports audio recording directly on to the editing layout and provides numerous essential features for editing clips. The customised fade options makes for a studio level sound mix and the tweak options on pitch, reverb, bass and treble control makes for significant fine tuning of your audio file. You can also experiment by adding beats, audio filters and others add-ons to truly enhance your audio mix.

deviantArt muro

Anyone familiar with image art, graphics, design or photography on the internet has heard of Deviant Art. The popular image sharing website now has a Chrome OS web app that works as a very useful image editing application. Repeatedly touted as being a superior tool in terms of functionality, speed and flexibility, it is hard to deny once you begin playing with it. Its free to use service along with its fully loaded layer support design capabilities make is one of the most impressive editing as well as design web apps available. The ability to draw directly within the app is similar to how you would use Photoshop, since lines and curves respond to a wide degree



Deviant Art's very own Chrome OS web app is a joy to behold

of pressure sensitivities and come packaged with 20 unique brushes. It covers all the needs of the professional as well as novice user and can be easily considered the most powerful web based design tool available. If your device has a Bamboo tablet type support then the results can truly be amazing. The web app is cloud based and compatible across numerous popular devices and platforms that allows for a seamless work environment for designers, artists and hobbyists.

SketchPad

For those interested in a simpler and more expressive means of designing graphics and art using web based applications, the SketchPad app is a must

have. Compared to many other fully loaded image editing and design based applications, it may seem limited but it serves to simplify the process while giving high quality results. The SketchPad app is best used as a painting tool which includes tools like paint brush, texture stamp and spiral effects. Each of the tools provided have a high degree of customisations and range which allow for a wide variety of designs to be possible. Since users can control settings like flow, opacity, jitter and girth, the complimentary use of texture, colour and gradient makes for a rich design potential. Its a fun and interesting approach to design and perfectly suited for someone with a more expressive, less rigid approach to graphic design.

Grooveshark

With the popularity of online music via platforms like SoundCloud, YouTube, Pandora and many others its hard to pick a favourite. For the Chrome OS web based options the clear winner is easily Grooveshark - albeit its just a website and not a full blown app, but its totally worth bookmarking. The service allows users to discover, listen and share music through their browser and is now available as a web app in Chrome OS. The internationally available music search engine allows your to stream music from anywhere in the world as well as upload music, all free of charge. The web app also has a highly accurate recommendation engine that suggests music based on your listening habits. The playlist management feature is also perfectly made for sharing and accessibility across any device.

Soundtracker

In terms of a new and innovative music web application Soundtracker is an interesting cross between social media networking and free music



If Pandora and Facebook had a baby, it would be Soundtracker

streaming. Described as “if Pandora and Facebook had a baby it would be Soundtracker”, it allows for a fun way to listen and explore music. Using a geosocial radio style Soundtracker gives users access to millions of songs for free and lets them broadcast their playlist like radio stations. The social network part of the app allows users to discover music via their friends list and comment on new music and playlists. The app can also show popular music in the local area of the user and access music across genres and artists. This combination of social media and music sharing makes for a fun and engaging way to connect over music with friends and strangers.

Games

Angry Birds

The name speaks for itself – the sensationally addictive mobile game was ported as a Chrome extension long ago and is now an integral part of killing time for any Chrome OS user. The game brings all the fun and games of the original (and its many sequels) to the browser making it must have for anyone looking to take a break from their work for a few hours.

RuneScape

For users who are interested in more mature and immersive gaming environments web app games based on rudimentary Flash or grunting pigs may not be enough. The concern over whether Chrome OS can truly be a home for gamers is still up in the air but with game apps like RuneScape this question may find an answer. This massively multiplayer online game



It's RuneScape. How can you not love RuneScape? You gotta love and play RuneScape.

has already captured the attention and imagination of gamers all across the world and is now easily accessible via Chrome OS. The fantasy game world between warring races, devastated landscapes and mystical powers makes for a fun and engaging pass time. The game is available free-to-play and can be accessed across any browser on computers. As of last count it is estimated to have over 180 million players worldwide so you'll never lack for quests and adventures.

Sinuous

Another genre of game that is available on the Chrome OS systems is called Sinuous. Unlike the many browser based MMORPG or first person shooter games, it is more subtle and surprisingly addictive. The seemingly straightforward game about guiding a little blue dot away from collision from many red dots with your mouse moves into overdrive as it progresses. The dexterity and reflexes required to accomplish the tasks in the game can prove highly challenging and enjoyable while being so simple and elegant in design.

Plants vs. Zombies

The highly popular PC and mobile game, Plants vs. Zombies, is a perfect addition to any gamer who wants to work on the Chrome OS without missing their passion. The game is available on a free trial, after which it is surely worth the price of admission. The fun and quirky game pits the player against an onslaught of invading zombies with the only defence being a weird assortment of plants. Using all the players strategy and timing, with a modicum of luck, the goal is to use your arsenal of peashooters, wall-nuts, cherry bombs and other horticulturally inspired weapons to ward off the zombie attack through numerous levels. With over 25 awards under its belt the game is a must have addition for any Chrome OS user who wishes to mix in a little fun with their work.

Others

Gmail Offline

It's exactly what it says – the Gmail Offline web app allows users to access a locally stored cached version of their Gmail data when they aren't connected to the internet. You can even compose and store replies to email which will be deployed once the connection is resumed – which in a country such as India can prove to be very useful especially if you're travelling or suffering

a network failure. The app also gives you access to your contacts address book so you can set up outgoing emails in offline mode and execute them as soon as you have a connection – perfect for enterprise users in India.

Jolicloud/Jolidrive

Similar to the Google Drive web app, the Jolidrive is a part of the Jolicloud family of apps, that has already found a following via its iTunes app and iOS services. Now available as a Chrome OS app, it combines the user interface inspired by Pinterest with the convenience of online data storage. It seamlessly allows hosting and accessing of all forms of data files from within the app making the need to download most files unnecessary. It also supports direct playing of audio, displaying images, editing documents, viewing videos and links, as well as exploring your social media content on websites like Facebook and Tumblr. It also doubles as a note taking service like Instapaper where you can clip and store articles for later reading.

Numerics Calculator and Converter

Another niche but highly useful web app, Numerics Calculator and Converter, will keep any scientific nerd or geek satisfied with its vast range of capabilities. The fast and easy to use advanced web based calculator is the leading product of its type and can run complex calculations with ease. The enormous input display of the app allows you to see results without abbreviation as well as a stored history of your calculations for easy referral later on. The app works offline and can take on even the specialised mathematical operations like trigonometric functions, exponential operations as well as customised programmable algorithms which you can add for any purpose such as hexadecimal, octal and binary calculations. The converter component of the apps keeps a synced check on up to date currencies showing you the time of the update as well. Indispensable for accountants, forex traders or nerds.

Feedly

An essential part of the online experience is the massive browsing of information. Users on Chrome OS can easily use the app to collect data from RSS feeds and let the app consolidate all the sources of information they prefer by making use of the Feedly web app that aggregates content from numerous websites and lays it out in using a personalised interface. The content gathering tool of Feedly lets users sift through the massive onslaught

of online content and access information that matters to them effectively acting as a content discovery and reading platform all at once. The minimal design and magazine style layout along with the fast refresh updates, cross platform functionality with Evernote, LinkedIn and others are what make Feedly a real pleasure to use.

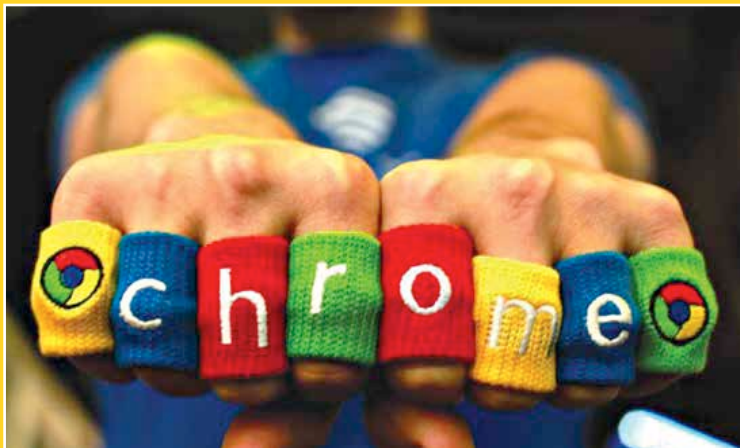


This lets you capture a screenshot effortlessly

Clipular

The Clipular app performs a simple but essential function one which adds to the value of Chrome OS. Clipular is a screen capture tool that lets users clip images and text from across the web and organise them to their Google Drive. Its a

great in-between option for people who want to retain the online storage of Drive but want the functionality of Evernote. The app also allows for basic image editing for anything that is clipped and lets you post it directly to social media websites like Facebook. A nifty feature of the app is that it saves the source URL link for every media that is clipped so users can backtrack to the source if they need to for any reason. Its perfect for taking image clips from Facebook or Twitter exchanges and even stills from YouTube videos. 



TIPS AND TRICKS

Starting off with a new operating system can be daunting but with a helpful list of tips and tricks any user will discover how easy and indispensable Chrome OS can be for most of their computing needs

So, you've decided to give Chrome OS a try. That's great but even as you go about learning its ins and outs, it's handy to get use to its design philosophy. Unlike other traditional operating systems most of your major activity are going to be confined to the web. Only when you wish to play local media will you be using the in-built media player, but otherwise will turn to one of the many millions of web apps that will help you accomplish your tasks.

The familiar task bar only hold the basic tools that come with the operating system – media player, Chrome browser and file manager. For all practical purposes the Chrome browser is going to be your gateway to the operating system and all its web based applications. The following shortcuts, tips, tricks and hacks are intended to help you make the most of the operating systems design as well as tweak around with its developer features that might interest you from time to time.

Productivity Tips and Shortcuts

Chrome Channels - Dev, Beta, Stable

Unknown to most Chrome OS users they have an option of three development stages at which they can use the operating system. These modes are known as Chrome Channels and offer different states of functionality



Change channels to tweak your Chrome OS experience

–Stable, Beta and Developer. These three different channels are functionality levels that users can opt to experience. The Stable channel of Chrome is the most tame version of the operating system and comes with all the fully functional apps. But the fun definitely takes place in the Developer and Beta channels with untested

and unreleased features being unleashed. Its a fun and useful method of trying out cutting edge developments on the Chrome OS. You just need to type: `chrome://help` into the browser and go to the More Info link to select the Channel of your choice.

Quick Refresh

Sometimes after hours and hours of surfing with dozens of tabs and multiple windows being active any machine will notice a slight lag in performance. In most cases you would be forced to shut down and restart the system so that the memory can recompile the work but with the Chrome OS you can just do a system refresh to cleanse the lag. Just hold the Refresh and Power buttons on the keyboard and Chrome OS will quickly shut and reboot superfast just like a system refresh with all your active windows and tabs ready to go.

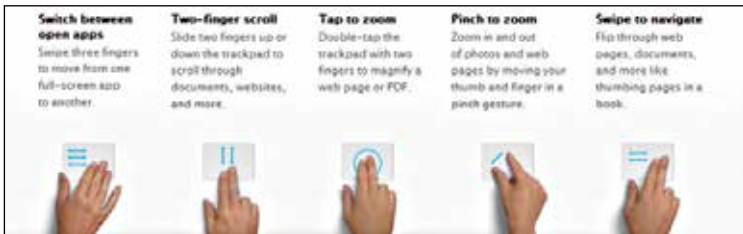
App Window Detach

The Chrome OS design keeps all apps locked into the Chrome browser window by default as tabs. But not every app needs to be run within a tab and can be opened in an along side window like a separate application.

This feature is specifically useful if you have a large screen display to spread out your work. Just press the Shift key while clicking the app shortcut in the App Launcher and it will open in a separate window just like an old school program.

Touchpad Gestures

One of the coolest features of the Chrome OS is its appliance mode which takes into account peoples mobile device habits such as the ergonomics of scrolling. On a touch display we are use to sliding upwards to scroll down and vice versa, so Chrome OS lets the device touchpad also react the same way – they call it Australian scrolling (cause Up is Down, and Down is Up, i the Land Down Under).



Learning touchpad gestures is a good way to quickly comes to grip with the new OS

And in the case of certain newer laptops, netbooks and Chromebook, the touchpads support multi-touch gestures which can prove invaluable as shortcuts to accomplishing frequent tasks. By swiping left or right with two fingers you can jump back and forth between previous and next web pages within the selected tab respectively. You can also use three finger touch gesture to swipe left and right in order to cycle through open tabs in the Chrome browser window.

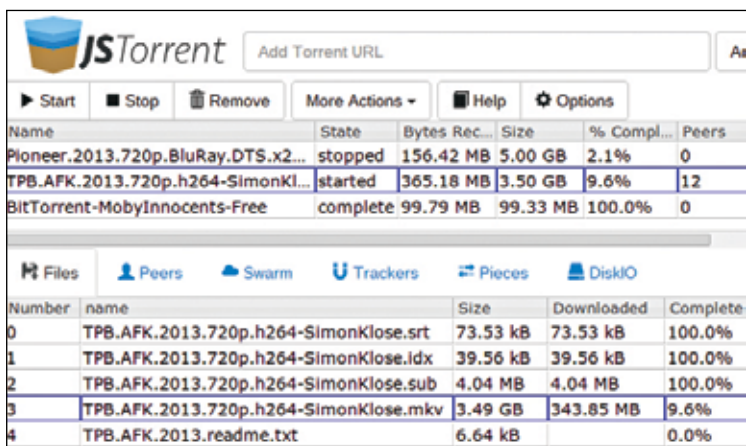
The most useful gesture function is the three finger upward swipe that pulls up the Task Manager in the Chrome OS. This converts you screen into a thumbnail contact sheet of all open tabs and apps. You can then select any app or tab of your choice or swipe down three fingers to resume where you were before.

Android Push

Due to Google's development of both Android and Chrome OS it isn't surprising that users who have Android mobile phones love the connectivity between the two systems. If you have an Android phone you can use the Pushbutton app to link the two devices. You will need to setup Pushbullet on your Chrome OS as well as your mobile phone which would allow your phone to push your notifications on to your Chrome OS display. You can also use Pushbullet to send links, share files and send contacts.

Torrent Downloads

Most heavy internet users rely on their freedom to access various content using the Bittorrent system and may consider Chrome OS insufficient for their purposes. But with the JSTorrent bittorrent application the ability to



The screenshot shows the JSTorrent application window. At the top is the JSTorrent logo and a search bar labeled "Add Torrent URL". Below this are buttons for "Start", "Stop", "Remove", "More Actions", "Help", and "Options". The main window displays a table of torrents:

Name	State	Bytes Rec...	Size	% Compl...	Peers
Pioneer.2013.720p.BluRay.DTS.x2...	stopped	156.42 MB	5.00 GB	2.1%	0
TPB.AFK.2013.720p.h264-SimonKl...	started	365.18 MB	3.50 GB	9.6%	12
BitTorrent-MobyInnocents-Free	complete	99.79 MB	99.33 MB	100.0%	0

Below the table are tabs for "Files", "Peers", "Swarm", "Trackers", "Pieces", and "DiskIO". The "Files" tab is selected, showing a detailed view of the selected torrent:

Number	name	Size	Downloaded	Complete
0	TPB.AFK.2013.720p.h264-SimonKlose.srt	73.53 kB	73.53 kB	100.0%
1	TPB.AFK.2013.720p.h264-SimonKlose.idx	39.56 kB	39.56 kB	100.0%
2	TPB.AFK.2013.720p.h264-SimonKlose.sub	4.04 MB	4.04 MB	100.0%
3	TPB.AFK.2013.720p.h264-SimonKlose.mkv	3.49 GB	343.85 MB	9.6%
4	TPB.AFK.2013.readme.txt	6.64 kB		0.0%

If you're concerned about how to torrent files on Chrome OS, you need not worry

download torrent files directly to your Chrome OS has never been easier. The JSTorrent bit torrent client is designed for low hardware devices and can handle data transfers of large sizes as well.

Personalized Music Sync

You may also wonder if its possible to manage your music collection with a device that runs Chrome OS. Yes its true that you can't install iTunes or any other music management program, but with the prevalence of the cloud system you don't need to anymore. You can opt to upload your music

library and playlist to Google Music and stream it directly on the Chrome OS without any problems.

Under the Hood

Even though Chrome OS seems like a plain jane thin web client with a minimalist layout there is a lot happening behind the scenes which can be of interest to a power user. By logging into the system details of the Chrome OS's operations you can gain valuable insight about your usage patterns from battery information to a quantified analysis of your Wi-Fi connection. All you need to do is type `chrome://system` in the browser omnibar and you will be directed to an in depth view of the happenings behind Chrome.

Voice Control and Assistance

Very much like the Google powered Moto X series with their Google Now virtual assistant, it's not surprising that a variation of that feature finds itself within the Chrome OS. The voice search feature on Google search engine has been around for a while but with the use of the Chrome OS environment it makes an effective foray into the world of mainstream computing. All you need is to add a beta released extension of the Google Voice Search to Chrome and you'll be able to directly speak your search queries to Chrome. With recent developments from Google Now, you can also ask personalised contextual questions to the service such as "What are my appointments today?", which would then be accessed using your Google Calendar information. As more features and functionality is added to the Voice option you can be sure to expect an version of Google Now to be the virtual assistant of Chrome OS as well.

Connectivity Diagnostics

Occasionally on any Wifi and 3G connection devices experience fluctuations and glitches in performance. In Chrome OS you don't have to suffer these delays passively and can investigate into the problem without requiring a degree in computer sciences. Chrome OS comes with a handy diagnostic option which is available through the Developer Channel and can be executed



Run connection diagnostics tool in a jiffy

by typing in `chrome://diagnostics` into the omnibox of the Chrome window. This command takes you to a network dialogue box where you can select the connection choice of your interest – 3G or Wi-Fi. After your selection, Chrome proceeds to run tests on the selected network adaptor and displays the results of the test. The test results are easy to understand and make sense of since Chrome begins its analysis from the hardware up showing a green tick mark for every stage of the diagnostic process. Following this systematic process you can see exactly where the problem lies and take appropriate steps to rectify the situation.

Making Tabs Private

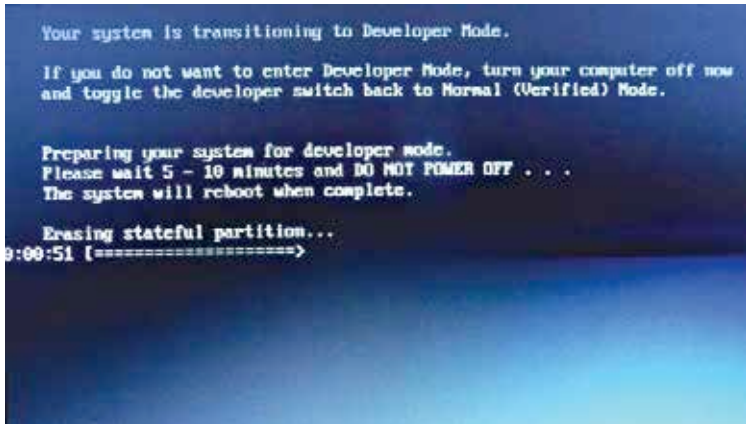
Given the mobile nature of Chrome devices, especially netbooks and laptops, the issue of real world privacy is also of major concern. Many times you may not wish for prying eyes to look over your shoulder and see which tabs and windows you are working on. In order to assure your real world privacy Chrome OS comes with a neat option of hiding a window of your choice away from the primary display without closing it down. All you have to do is separate the tab that has the private app or website and pin it to the task bar so it's accessible at a moment's notice without being open for public viewing.

Using External Displays

Unless you have a very large laptop it's highly probable that you are using a compact mobile netbook with limited screen real estate. To truly make the most of Chrome OS's many features, it's advisable to use external displays when you have a vast workload so you can spread out and organise your tabs without cramming them all into one horizontal bar across the top of the screen. For this purpose setting up an external display to a desktop monitor or projector or television is excellent and can be accomplished with ease. Once you've connected your Chrome OS device via its video port to the external display you just have to open the Settings page and go into the Devices section. Here click on the Display Settings option to configure how your external display should be shown. If you happen to have a Chrome Cast device you can also do this wirelessly from your Chrome OS device to any compatible external display.

Accessing BIOS Settings

For more advanced users who wish to check the underlying systems behind Chrome OS, the ability to access the BIOS settings is a must.



Accessing the BIOS through Chrome OS isn't difficult at all

This accessibility can even allow those comfortable with tweaking to install parallel operating systems on hardwired Chromebooks. To access the firmware of your Chrome OS device you need to be in Developer mode and start the Developer Terminal by pressing Ctrl+Alt+T and type in: `/usr/sbin/chrome-os-firmwareupdate - V | grep "BIOS version"`. You can also view the information using the primary user interface by typing in `chrome://chrome/help` in the omnibar. You can also type in "shell" in the developer terminal to access the shell prompt. From here you can access the SSH options by typing in "ssh" and pressing enter. The format for doing SSH from the developer terminal is simple: `ssh username computername@Ripaddress`.

Change Transparency

With many windows, tabs and active media files it can be helpful to have control over the transparency and opacity of the windows. You just need to type in `chrome://transparency` and you will be taken to the options to change it.

Quick Image Edit

You may not always need a full featured image editor like Pixlr to make minor adjustment to images. For these cases all you need to do is to press "E" while viewing images in the Chrome OS File Manager and the in-built image editing application will launch giving you all the basic tools.

Camera App Tweak

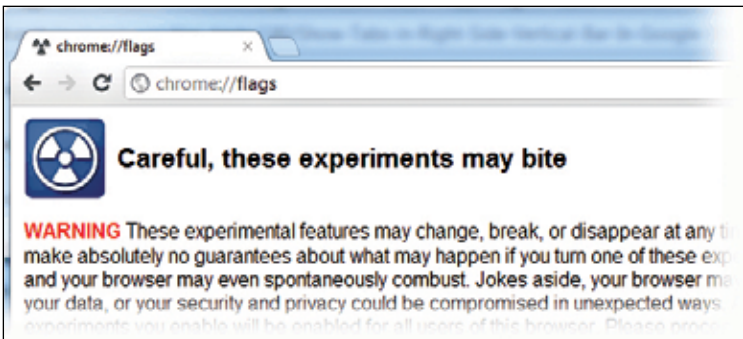
The camera app in Chrome OS accesses your machine's camera and allows you to take photographs for profile displays but if you type **CRAZYPONY** in the app you'll be given the option of choosing a video file to watch and apply any of the style effects of the camera app to the screenshots of the video.

Switching Accounts

Given the cloud hosted nature of Chrome OS applications it isn't unlikely that many people may use one Chrome OS device like a desktop or workstation in any given environment. For that purpose having multiple accounts on the same machine isn't uncommon. To quickly switch between different accounts all you have to do is press **Ctrl+Alt+Period** and **Ctrl+Alt+Comma**.

Experiments May Bite

Chrome OS is a system that is under constant development and on Chromebooks is seamlessly updated without any notice. But many of these updated features begin as experiments that are tested in developer mode and beta



Be careful with your Chrome OS experiments, as they may bite you back

mode for a while before making it to any stable update. Some of the experimental features can be very useful for most users and are worth testing out from time to time. In order to access these experimental features you just need to type in **chrome://flags** in the omnibar and a screen will be displayed with all the available experimental options. But be wary of glitches and problems as the warning advises: Careful, these experiments might bite. No need for worry since you can always roll back or simply turn off these features anytime you want.

Must Do Security Tips

Chrome OS is designed to be a secure and protected system that protects you from the kernel upwards against any malicious program. But disruptions and frauds targeted towards you via online mechanism can't always be prevented in real time by even most anti-viruses as they don't rely on programming but information gathering. By following a series of steps from within Chrome OS you can ensure that not only are you safe from online scams but also from websites that secretly gather your surfing habits.

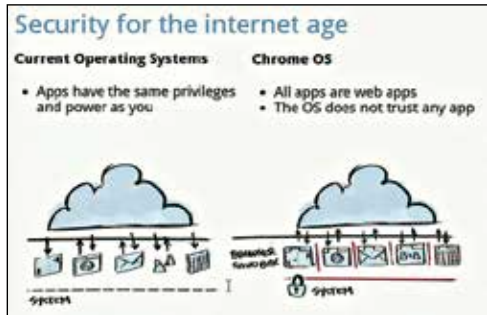
1. Chrome OS's is automatically set to enable phishing and malware protection from the browser interface but you can always double check to ensure it hasn't been deactivated by going to the Settings menu.
2. You can protect your privacy and surfing habits by sending a "Do Not Track" message along with your browsing traffic which would direct websites you visit to not track you. This is of course not a foolproof way of protection since many websites do not recognise or respect the "Do Not Track" request. But it is essential to enable as many sites are obligated to follow it due to their own internal corporate policies.
3. Chrome OS machines are highly efficient at saving battery power and go to sleep when the lid is closed. Due to their very fast load time its an easy option, but in the while you are away from the device it can be accessed by anyone. A good way to protect yourself from this risk is to enable "Require Password to Wake from Sleep" option. To activate this feature you need to go to Settings and type in "wake" in the omnibox.
4. If you are individual user who doesn't intent for the device to be shared by many people, its advisable to not let every causal user set up a full account login on your machine. Its better to restrict them and have them use the guest login. You can also create a custom list of allowed users by typing in "restrict" in the omnibar and clicking on the "Manage users" options to select "Restrict sign-in to following users..." where you can manually allows limited accounts.
5. As we know, nearly all the websites on the internet track the surfing habits of all their visitors to some degree. Other more aggressive websites go on to secretly collect personal data and create a shadow network on online connections that retrace your usage patterns. A handy defence against such intrusion is the "Collusion for Chrome" app extension that gives you a display of the spread of your data and its exposure to various sites in real-time as you use the web. From this point it allows you to choose which connections seem valid and which seem suspicious, and lets

you disconnect the trackers directly.

6. A generic but very essential advice for Chrome OS users is to not use any app or extension that hasn't been verified and downloaded from the Google Web Store as it presents a poten-

tial risk for exposing your machine to malicious software. This advice is not to negate open source creations from a trusted community of developers which you may be aware of, but shouldn't be extended any random curiosity that you find online as it is a perfect trojan horse that can compromise your personally stored data.

7. Even though all the extensions and apps available from the Google Web Store are verified and secured they need to be monitored for how much of your system resources they are consuming. Sometimes these apps are inefficiently designed or bloated which leads to them influencing unnecessary parts of your operating system. You can curb this behaviour by running a security audit on the apps and extensions by typing in: `chrome://extensions` and selecting the Permissions option. This will display the permissions that have been granted to any particular extension. If you observe that any of the extensions are not really necessary or are accessing information they shouldn't need to, go ahead and disable their permissions and possibly delete the extension from your system.



In a cloud environment, security is the key

Remote Access

Chrome OS comes with Chrome Remote Desktop extension which is great if you need to remotely access your machine. This can be especially useful when you need to work between your Chrome OS device and a non-Chrome OS device like Windows or Mac. By setting up a remote access desktop on these non-Chrome OS machines you can easily share data, improve functionality and virtualise your operating system all from within the Chrome OS. Third party apps like AccessToGo are perfect for Windows remote desktop

access and RealVNC Viewer for Google Chrome creates a secure VNC link between your Chrome OS and almost all other operating systems.

Keyboard Shortcuts

The keyboard layout of the Chromebook differs from traditional QWERTY layouts. Although the main word processing typing area is formatted the same way, there are numerous replacements of other buttons, especially the F1-F12 keys, in their place you will find Hotkeys which have assigned shortcuts. If you have a Chromebook you can easily press Ctrl+Alt+? to

KEYS	EFFECT
Ctrl+N	New Window
Ctrl+Shift+N	New Incognito Window
Ctrl+T	New Tab
Ctrl+O	Open file
Ctrl+Shift+Q (twice)	Logout of Google Account
Ctrl+W	Close Active Tab
Ctrl+Shift+W	Close Active Window
Ctrl+Shift+T	Reopen Last Closed Tab (upto last 10 tabs)
Ctrl+1 to Ctrl+8	Go To Tab at Numbered Position
Ctrl+9	Go To Last Tab in Window
Alt+1 to Alt+8	Launcher Items
Alt+9	Go To Last Open Window
Ctrl+Tab	Go To Next Tab in Window
Ctrl+Shift+Tab	Go To Previous Tab in Window
Alt+Tab	Go To Next Open Window
Alt+Shift+Tab	Go To Previous Open Window
Hold Back or Forward Key	See Browser History
Ctrl+Click	Open Link in New Tab in Background
Ctrl+Shift+Click	Open Link and Go To New Tab
Shift+Click	Open Link in New Window
Enter URL Press Alt+Enter	Open URL in New Tab
Ctrl+Shift+L	Lock Screen
Ctrl+K or Ctrl+E	Direct To Search Bar, Enter Query After ? Sign
Ctrl+Shift+I	Developer Terminal
Alt+Shift+M	Open Files App
Ctrl+J	Open Downloads page
Shift+Esc	Open Task Manager
Ctrl+Alt+?	List of Available Keyboard Shortcuts
Ctrl+E (In File Manager)	Create New Folder



Keyboard shortcuts will help you a long way in learning to handle the new OS experience

get a list of all the keyboard shortcuts whenever you need. But for basic Chrome OS users the following table presents all the keyboard shortcuts needed when not using a Chromebook keyboard.

Any proficient computer user knows that their work flow can be significantly improved using shortcuts. But many times the default shortcuts don't work for all users, in the case of Chrome OS users this feature isn't a problem as you can easily customise your preferred keyboard shortcuts using a very handy Chrome extension called Shortcut Manager. The extension is available in the Chrome Web Store and allows you to easily map your preferred key combinations for most shortcut functions. 



FUTURE OF CHROME OS AND CLOUD COMPUTING

In an era of unrestricted, blazingly fast internet connections, just how will Chrome OS evolve to enrich its end user experience? We try to gaze into the crystal ball.

The cloud is but a connected ecosystem of devices and the possibilities become infinite with the Internet of Things. In the future, cloud computing is set to take on a real-time, anticipatory intelligence role which will be able to predict our activities and needs before they happen. The current projects around the world will give a massive boost to cloud computing, making it more viable and within reach of everyone. A few examples of such projects are the Google Fiber project which aims to provide blazing fast internet speeds at 1000Mbps and then there is Project Loon, which aims to bring connectivity to rural and remote areas, thus ensuring that you are never out of range.

Future of Chrome OS

Chrome OS works like a pure web thin client, giving you access to online apps and data stored on the cloud. It is currently limited in apps due to certain factors like internet bandwidth size, connectivity, clash with Android OS and other such issues. But the future is bright none the less as technology advancements keep coming in.

Adaptation

Chrome OS is currently limited to lightweight applications as it is restricted by internet speed but it will soon be seeing much more full fledged, data heavy, online applications in the near future as broadband speeds are set to explode. Consider the Google Fiber project, it offers 1,000Mbps of upload and download speeds. Working with heavy files would become a breeze and the heavy processing would be taken care of at the cloud end. Video editing anyone?

Another concern with regards to Chrome OS was connectivity; people wouldn't be able to work on their files stored on the cloud in areas with no connectivity, unless they download their files and work offline with them. Several companies including Google and Facebook have embarked upon ambitious projects to provide internet connectivity to rural and remote areas via. balloons, drones and satellites. If these projects see feasible success then Chrome OS will become the first choice for affordable computing everywhere, especially the developing countries, be it for personal use or business.

With the number of apps that are being added to Chrome Store, it won't be long before you see web-based versions of popular desktop apps available. This would effectively give Chrome OS the edge it will need to compete with

full-fledged systems. For the moment, Google's partnership with virtualization vendor VMware enables Chrome OS users to access legacy Windows applications through a browser tab.

Affordability

Quite simply speaking, Chrome OS based devices will follow Moore's Law soon. Chrome OS ensures that it works with hardware that is affordable and easy to obtain.

OS clash

Though it is being denied at the moment by Google, in the future, Chrome OS and Android should see a successful merger. Thus unifying the experience of using google services. Also, considering the nature of the two operating systems, it makes sense for Google to unify them gradually.

Tablet adaptation

Chrome OS, with all the success it is having, would soon see a tablet adaptation of itself in the future as some of its recent updates (onscreen keyboard, ability to use device features with pointing device, etc) seem to point in that direction.

The larger picture

Cloud OS will cease to be simple operating systems in the near future because artificial intelligence computing like Anticipatory Systems powered by massive supercomputers will give rise to OSs who can not just answer back but also ask questions. There will come a time when one won't need to switch off an OS ever, just say "goodnight and see you in the morning".

The competition

Google isn't the only one riding the cloud OS wave. There are plenty of other operating systems out there for you to try out. A few of them are:

iSpaces OS

iSpace is a cloud based OS that is device anonymous, which means that it can be accessed from any device. It uses the Rocket browser which is like a browser within a browser (you can access it from the device's own browser) to give you access to web pages and apps. Its persistent login feature keeps you logged into websites and apps within the Rocket browser across devices.

It runs on any standard device browser like Chrome, Firefox, Opera, IE and Safari, and it is also compatible with different platforms like Windows, Mac and Linux and doesn't require any download. You can create multiple virtual desktops in it which allows you to keep your data organised. iSpaces is secure as it provides encrypted storage and backup. It has a built in file manager which allows you to organise your local, iSpaces, Dropbox and Box.net files. iSpaces uses data compression techniques and hence delivers quickly to the system.

SilveOS

Silve OS is a free Microsoft Silverlight based cloud OS. It requires MS silverlight to be downloaded and installed before it can be used. It consists of several applications such as a file explorer, a web browser, a video player, an RSS reader, notepad, a drawing application, a twitter client, a Flickr viewer, a Youtube viewer, a chat program, calculator and a few games like Solitaire,



Go ahead, have a slice of SilveOS. It won't bite, rest assured. Go on...

Spider, CHess and Minesweeper. Applications run in Silverlight's security sandbox and by default it is restricted from accessing your system's file system.

ZeroPC OS

ZeroPC is a commercial (a basic free plan is also available) browser-based OS which looks and feels like a desktop-based operating system. It can be accessed from any browser on Windows, Chrome, Mac, iPad/iPhone

and Android. ZeroPC focuses on Firefox and Chrome for the complete experience, although other browsers will work as well. ZeroPC provides integration with content sharing services like Box.net, SugarSync, Google Drive and allows you to share content between these services by using simple drag and drop functionality. ZeroPC allows you to share content (file or folder) with others by sending out an email to them with a customised URL to download the content. It comes with some native applications like a universal inbox that can consolidate your email and Facebook updates, a simple text editor, and a file explorer for managing all your content. It also come with ThinkFree Office for creating and editing documents, spreadsheets and presentations online.

Cloudo OS

Cloudo OS is still in Beta mode but is open for signup and use. Cloudo can be accessed using the web browser and hence is device anonymous. It

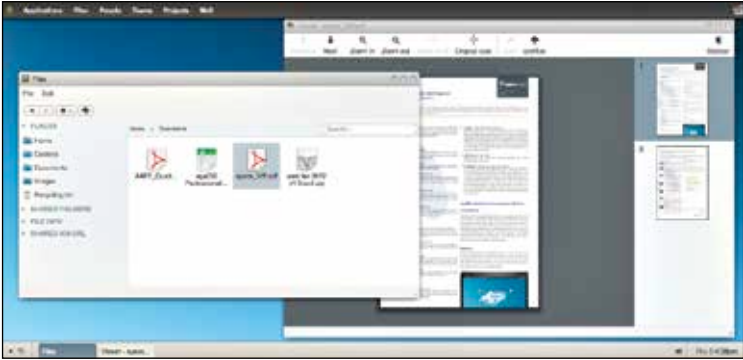


Still in beta, Cloudo OS is a nice concept OS, which can be accessed through a browser

offers applications like mail, word processor, music, calendar, RSS reader, etc. Its application manager lets you install or remove applications. You can share files or if you want, it also allows you to set up a joint account with friends or colleagues.

EyeOS

EyeOS is a professional cloud based OS with a focus on collaboration and communication amongst users. It comes loaded with a lot a personal, pro-



If you're looking for a cloud OS focused on collaboration, try out the EyeOS

ductivity and social tools. In personal tools it has a multi-account mail client that allows you to securely attach and download files, a calendar which can be shared with team members or sync with your mobile device, an address book which can import contacts and can be synced with a mobile device, file manager, etc. In productivity tools it offers one unique functionality where you can open a file based in the eyeOS using a local app on the computer; any changes on the file will not be saved on the computer but on the eyeOS cloud. It also allows you to work in offline mode. In its social tools it has made it easy to collaborate and share within teams with tools like the shared wall, task manager and chat for teams. You can create projects and assign tasks within teams. It also lets you create forms for surveys within the team about an issue which you can then study and share the result as a statistic. One very important feature is that any windows legacy app can be virtualised and delivered as a service to users.

The Place A

The Place A is a cloud-based operating system with built in widgets that offer a host of functionalities. You can chat and share files with other users of The Place A using its internal messaging system; receive emails in its mail client, manage files using its file manager(drag and drop from computer to The Place A is also available) which can be used to share files with others and also can be used as a text editor and picture viewer. Its online auto-backup functionality requires a download to auto backup the files from your computer to The Place A. Apart from these, it has a mini calendar, a group calendar which can be read and edited by everyone who



Music is something we can't live without. Not even on the cloud, no.

belong in a certain group, a simple note app, an address book which also works with the mail client, a cloud jukebox which allows you to upload mp3 or midi files and play them anywhere, an internet radio app and some games.

Corneli OS

Corneli OS an experimental, web-based, multi-user operating system that can run in a web browser. Corneli OS includes CIOS which is a powerful web application framework, using which you can build community platforms, social networks and web applications. The files and apps are stored on the cloud



Another OS that runs in your web browser

and can be accessed anywhere and at any time. Corneli OS also has a Virtual File System, using which you can share and protect files and directories, control access and automate backup mechanisms. Corneli OS includes a useful set of apps like a file manager, a user manager, a Content Management System and even a database manager. Corneli OS is available under two different licenses, the free Open Source GPL license and the CEL enterprise license.

Glide OS

Glide OS is a cross-platform, cloud-based desktop which is compatible with a wide variety of browsers like IE, Firefox, Safari and Chrome. It features a desktop-like interface and features several web-based applications like a photo editor, office suite, media player, calendar, webmail, address book, microblogging service, etc. You can set up and administer multiple accounts using the Glide OS settings panel. It provides automatic file and application compatibility across devices. The Glide Sync app makes it possible to access all your files from your mobile and automatically sync and download it to your system.



An OS that runs in a browser and accessible through an app that syncs data back and forth

Zimdesk

Zimdesk is a cloud based online operating system and consists of several applications. It has a simple text editor and a spreadsheet editor which can save files in Microsoft Office compatible format, a POP3 based email client, a calculator, calendar, contacts manager, RSS reader, web browser, file manager, a web-based radio app, an FTP client and a few games. Zimdesk has a process manager like traditional operating systems.

Windows 365

Apparently Microsoft is working on Window 365 according to leaks. If this

is the case then we can be sure that Microsoft will be going Gung Ho with its cloud based operating system.

Adjusting to the change

Change is the only thing constant and yet we resist change because the fear of the unknown always prevents us from going forward. Following are a few concerns and their explanations that should put your mind to ease.

Trusting your data with the service provider

With all controversy over privacy of data, this is a very legitimate concern. However, there are service providers who provide encryption service for your data. Some companies use the latest encryption standards to encrypt your data as well as your sessions so that your data is protected from the internet. Also, before moving your data to the cloud, you should ensure that your service provider uses proper security hardware like dedicated hardware firewalls and that they have security specialists on board with them. If all these requirements are met that you don't have to worry about the safety of your data and can move it to the cloud. In fact, your data will be much more safer on the cloud than on your system from where it can be easily stolen.

Cost

This is one prime factor which separates services. You should list down the expenses of using a full fledged system which includes the cost of the full-fledged OS, word processing applications, antivirus subscriptions, and yes, the full-fledged system hardware, vs the cost of using a low cost device which can access the Cloud based OS and data easily. Of course, your requirements must also be considered, like for instance, if you are into heavy video editing then a full fledged system is for you otherwise if your work is limited to word processing, emailing, light image editing then a web based OS on a low cost device is the one for you.

On the other hand, there are plenty of free storage options that you can access from big companies. This gives cloud based storage a big plus point.

Data Access

If you are constantly in a connected environment then there is no issue, but if you move out of connectivity often then you much go for an OS that supports offline storage and working capability.

Data availability after contract

One thing that you should have cleared with the service provide before moving to a cloud based OS is that what will happen to your data after the contract is terminated. Will they offer you tools to transfer your data to another service? Will they give you grace period to download all your data? These are important questions that should be asked before shifting to an online OS and cloud based storage option.

Conclusion

Moving to a cloud based system and storage is not just a cost-effective solution. It is the future, the next phase of evolution in computing. Perhaps, if Microsoft had waited and launched its Kin 1 and Kin 2 mobiles now, they would have been a success. 



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